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AUGUST 14, 1959

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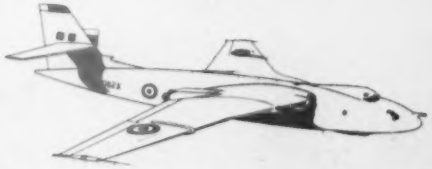

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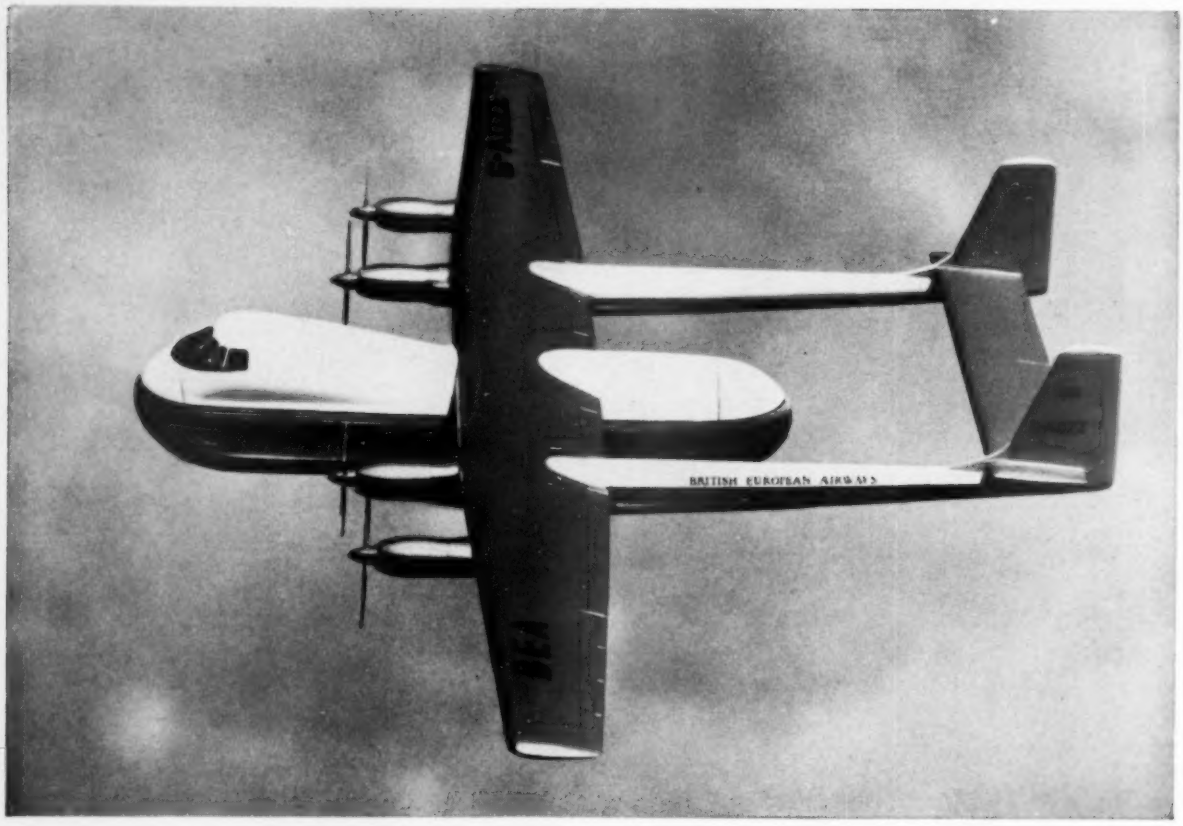

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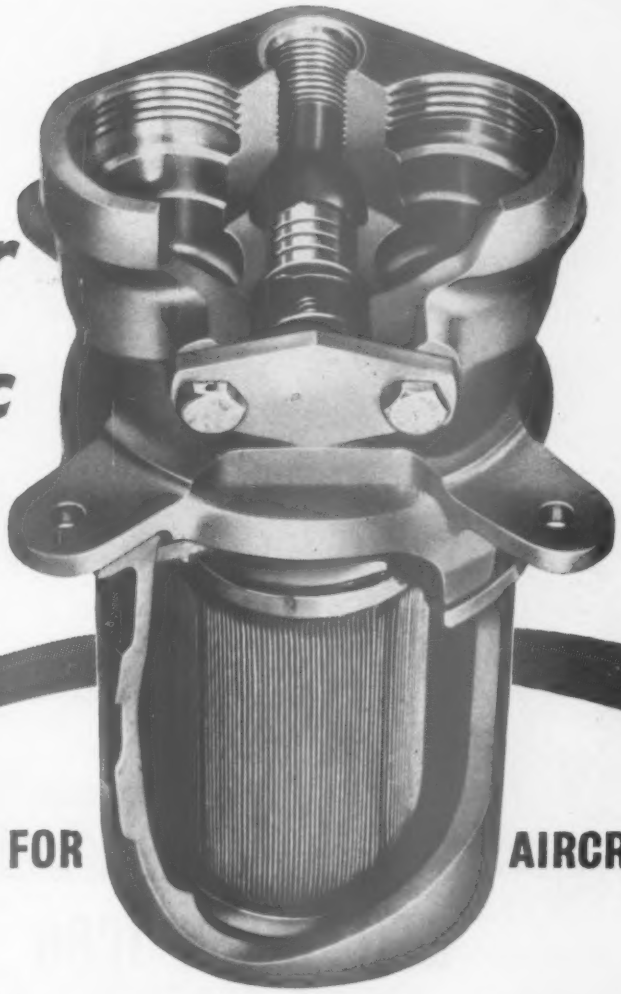

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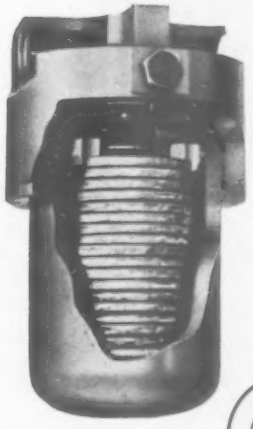

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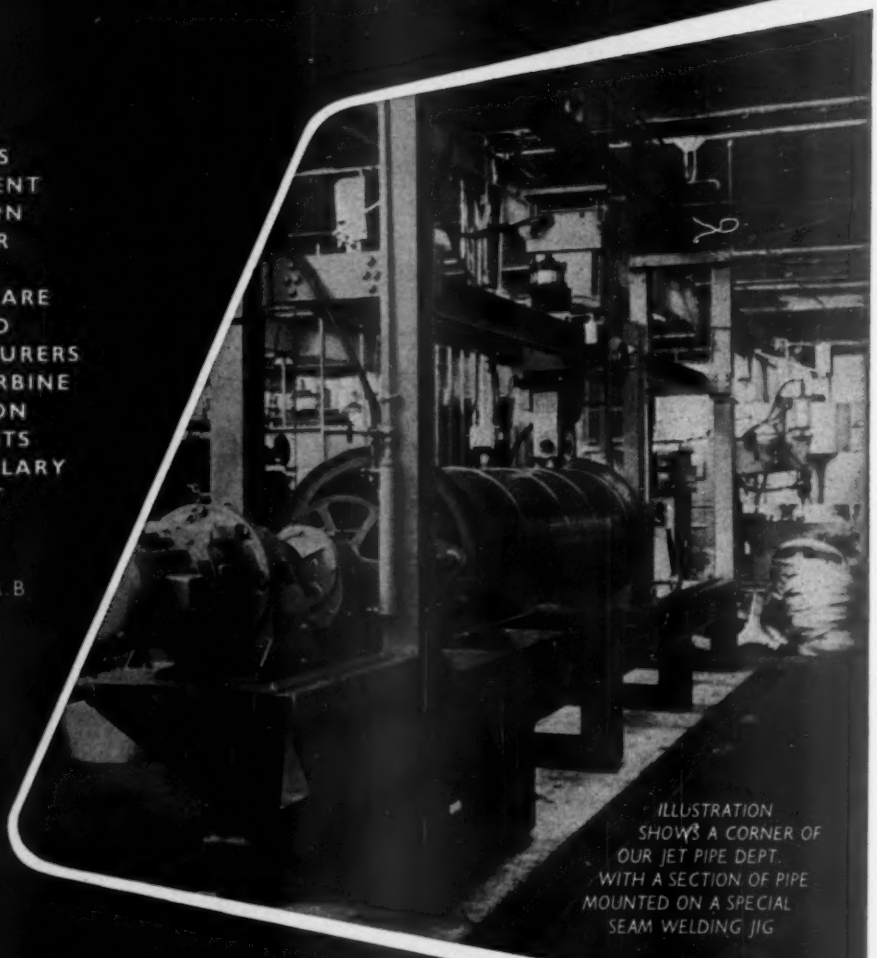

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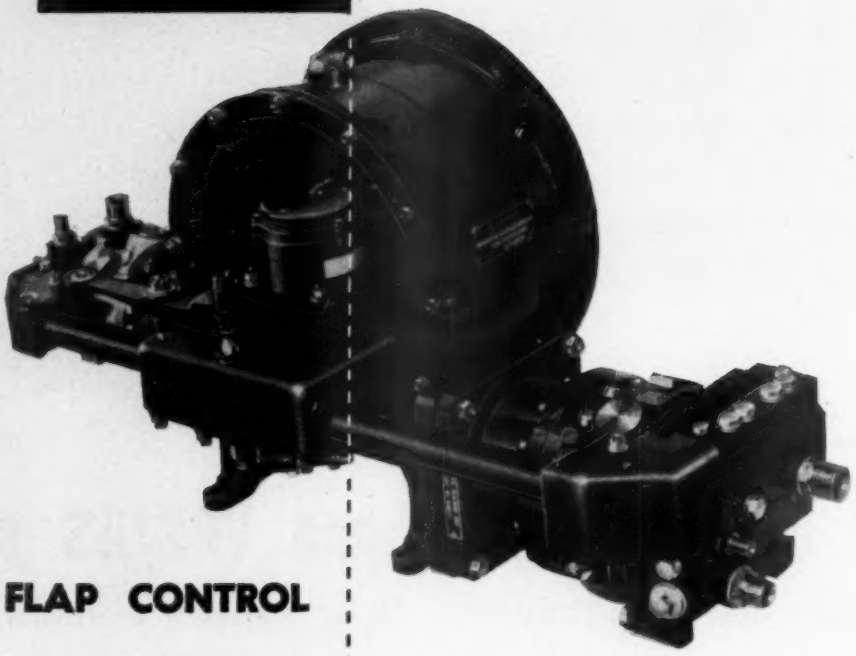

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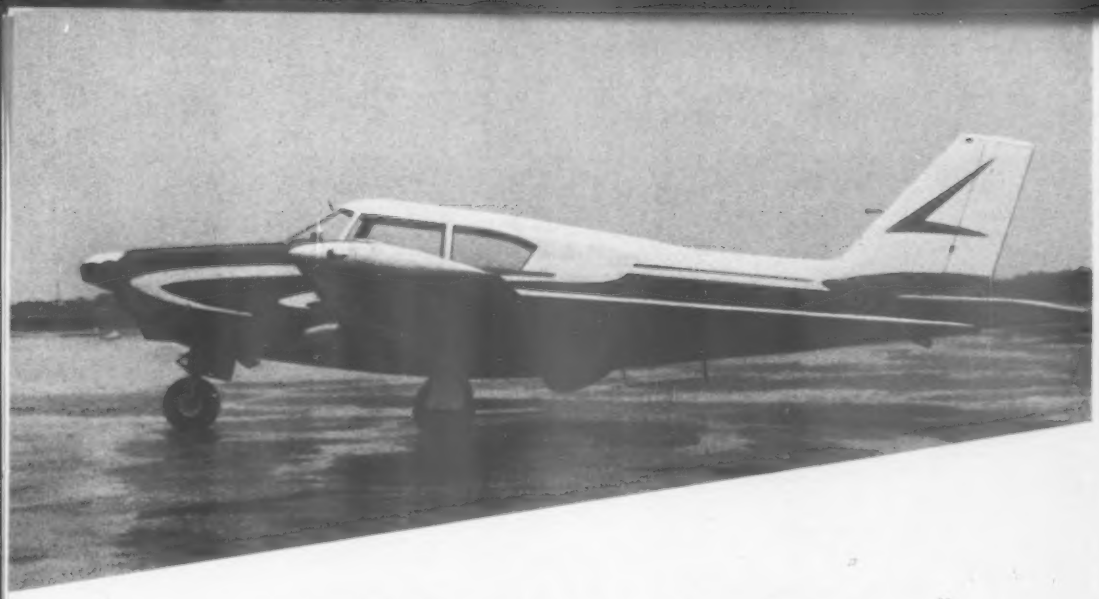

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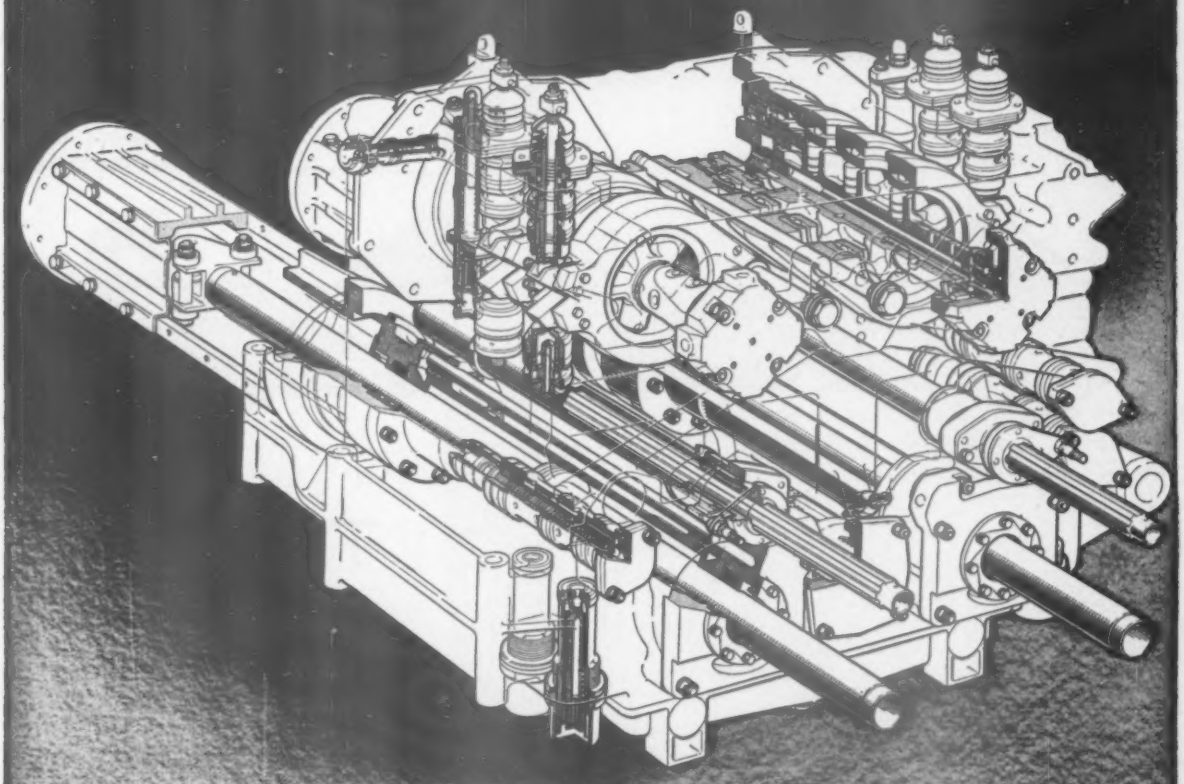

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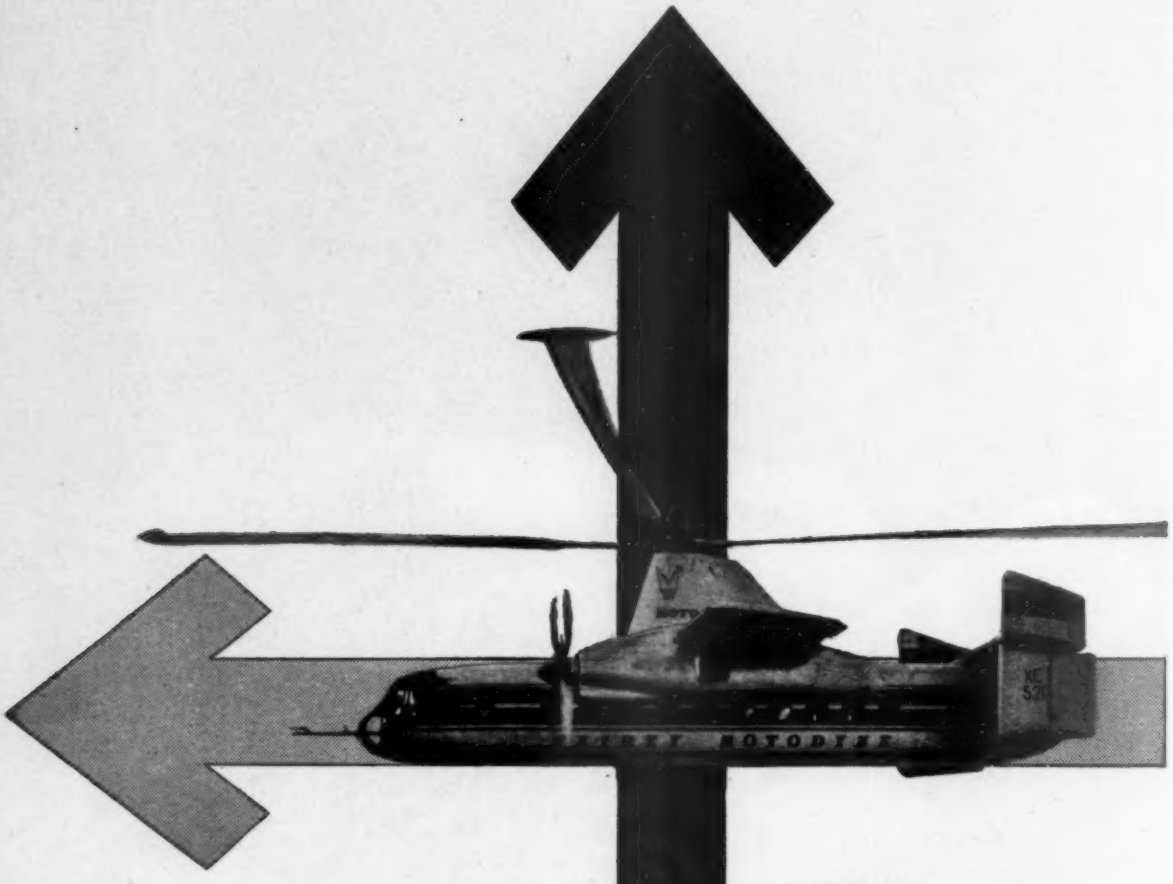

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THE AEROPLANE and ASTRONAUTICS

VOLUME 97 NUMBER 2495 AUGUST 14, 1959

Back on the Job

This is the first issue of THE AEROPLANE AND ASTRONAUTICS to appear since that of June 19 last. In the eight weeks which have gone by since then there have taken place the Paris Aero Show, the National Air Races, and the Blériot anniversary celebrations, of which the most spectacular and internationally acclaimed was the *Daily Mail* Air Race. There has been a Government debate on the state of the aircraft industry, pronouncements by the Minister of Transport and Civil Aviation and mergers in the Industry.

This issue which has necessarily had to be put together under considerable limitations, contains a full eye-witness report of the Paris Aero Show, that international event which takes place every other year, and forms an irreplaceable measure of aeronautical progress. For the rest of our limited space we have commented on certain happenings of paramount importance, not overlooking new appointments which have taken place in the aircraft industry.

Next week we are planning to catch up on all events, hitherto unrecorded and unreported. Included in such features will be an analysis of the performances of the 117 entrants who took part in the great *Daily Mail* Air Race, an account by John Fricker of flying one of the most successful high-speed aircraft in that race, and an account of the National Air Races and Aerobatic Competition at Coventry.

Subscribers are advised that arrangements have been made whereby current subscriptions will be extended to allow for those issues not published.

Six Minutes in Eleven Years

Ever since the young Moore-Brabazon won £1,000 from the *Daily Mail* for being the first to fly an English aeroplane for a circular mile, a long succession of historically memorable aeronautical achievements have been directly due to the generosity of the great paper which Lord Northcliffe established. Among the most important of all events is, without doubt, the first crossing by aeroplane of the Channel by Louis Blériot on July 25 in 1909. Fifty years afterwards on the same day Lord Rothermere handed cheques amounting in total to £11,000 to the successful competitors in the imaginatively conceived Arch to Arc Air Race. This demonstrated that not only the young and agile, but the well-preserved businessman of middle age, can be safely, if strenuously, transported from the middle of London to the middle of Paris in just over 40 minutes. Equally impressive, and potentially of even more value, was the remarkable achievement of the Bealine Syndicate in doing the job the airline way in 61 exciting minutes. It is quite certain that the Ministry of Transport and Civil Aviation cannot continue to accept the present three and a half hours as being necessary after such demonstrations.

We of THE AEROPLANE, as it was in 1948, take a special pleasure in the success of the *Daily Mail* Air Race, because on September 30 in that year, the operation "Hare and Tortoise" organized and sponsored by this paper, demonstrated that the journey from St. Paul's in the City of London to Les Invalides in Paris could be performed in 46 min. 44 sec. This wonderful achievement was performed with the aid of the Bristol Aeroplane Company, who made available the helicopter which flew to Biggin Hill in 9 min. 35 sec., of the Gloster

Editor - - - THURSTAN JAMES
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Founder Editor (1911-1939) *C. G. Grey*

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Company, whose Meteor flew from Biggin to Orly in 27 min. 38 sec., and of the Westland Company whose S-51 completed the journey in 8 min. 30 sec.

It remains a sobering thought that in the intervening years the improvement in aircraft performance—the Hunters were cutting the Meteor's time by 10 minutes—has been so offset by traffic problems that only six minutes have been clipped off the "Hare and Tortoise" time.

It is perhaps not too much to hope that now the attention of the entire population of the British Isles and most of France has been concentrated on the journey time between the two capitals, that the civil servants will get busy cutting process time; we must be able to count on doing the trip from city centre to city centre in two hours. In these days of supersonic flight an average speed of 100 m.p.h. between London and Paris should not be unduly ambitious.

Matters of Moment

India Chooses the Avro 748

FIRST firm order for the Avro 748 has come from India. Early in July the Indian Defence Ministry signed an agreement with Hawker Siddeley Aviation, Ltd., for the supply of Avro 748s to the Indian Air Force. The agreement also provides for the production of the Avro 748 in India; according to our Indian correspondent, this might be handled by the I.A.F. Maintenance Command at Kanpur.

In addition to this firm order for the Avro 748, the prototype of which is expected to fly next February, the Ministry of Supply is arranging to purchase three which will be used by a U.K. operator.

Keen competition had been engendered by the need of the Indian Air Force and Indian Airlines Corporation to replace their large fleets of Dakotas. Among the aircraft offered and evaluated, in addition to the Avro 748, were the Handley Page Dart Herald, the Fokker Friendship and an original design by Lockheed. Although Indian Airlines is not a party to the present agreement, the chances that it will buy Avro 748s are, obviously, now very good.

Astronautics in London

OF the 20 papers listed for presentation at the forthcoming Commonwealth Spaceflight Symposium (August 27-29) no less than 11 will be given by lecturers from the British aircraft, missile and radio industries. The remainder are being presented by delegates from Australia, Canada, India and South Africa, and by the colleges and universities.

Several of the technical contributions have themes which extend far beyond the limited programme of space research recently announced by the Government. Prominently featured in the programme are recoverable satellites, a manned orbital aircraft, and a hypersonic ramjet to act as a space booster. One particularly topical contribution considers the problem of adapting the Blue Streak LRBM as the first stage of an all-British satellite launching vehicle.

The economics of space-flight are the subject of three papers.

The Commonwealth Symposium, which opens at Church House, Westminster, is being organized by the British Interplanetary Society in conjunction with the 10th Congress of the International Astronautical Federation which follows at Church House from August 31 to September 5.

Congress papers will cover a wide range of astronautical topics by international authorities, including: (1) research applications of satellites and space probes; (2) existing and proposed projects for manned and unmanned space vehicles; (3) conventional and unconventional methods of propulsion in space; (4) problems of dynamics, control and navigation; (5) re-entry problems; and (6) biological and medical aspects of manned space-flight.

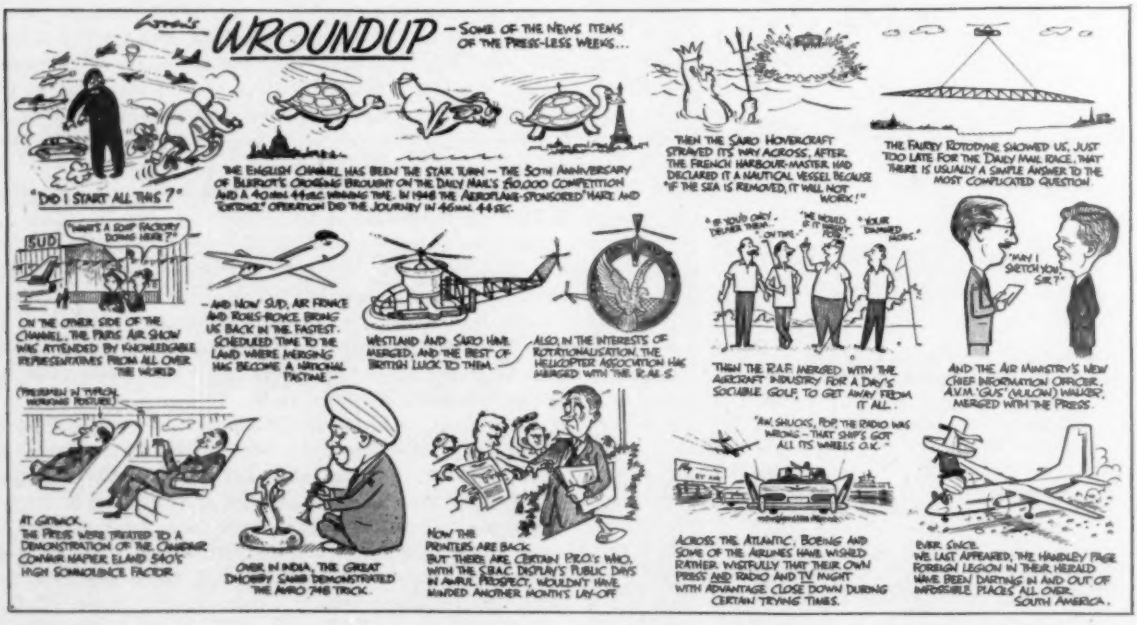
Nearly 100 papers are to be presented in parallel sessions by leading scientists and engineers from more than a dozen countries, including Russia and America. A Space-Law Colloquium will be held in the Great Hall, Lincoln's Inn, on September 4 under the chairmanship of Mr. Andrew G. Haley, the I.A.F. president.

Further information about the Commonwealth Spaceflight Symposium and the 10th I.A.F. Congress can be obtained from the Secretary, British Interplanetary Society, 12 Bessborough Gardens, London, S.W.1.

Rotary-wings to Merge with R.Ae.S.

BEFORE the year is out, the Helicopter Association of Great Britain is likely to have ceased its independent existence and become part of the Royal Aeronautical Society.

On February 18, a conditional agreement signed by the two presidents—Sir Arnold Hall, for the R.Ae.S., and Mr. Eric Mensforth for the H.A.G.B.—was drawn up. This indicated


WROUNDUP – SOME OF THE NEWS ITEMS OF THE PRESS-LESS WEEKS...
"DO I START ALL THIS?"
THE ENGLISH CHANNEL HAS BEEN THE STAR TURN – THE 50TH ANNIVERSARY OF BLERIOT'S CROSSING BROUGHT ON THE DAILY MAIL'S £10,000 COMPETITION AND A 40 MINS 44 SEC WINNING TIME. IN 1948 THE AEROPLANE-SPONSORED 'HARE AND TORTOISE' OPERATION DID THE JOURNEY IN 46 MINS 44 SEC.
THEN THE SARO HOVERCRAFT SPRAYED ITS WAY ACROSS, AFTER THE FRENCH HARBOUR-MASTER HAD DECLARED IT A NAUTICAL VESSEL BECAUSE "IF THE SEA IS REMOVED, IT WILL NOT WORK!"
THE FAIREY ROTODYNE SHOWED US, JUST TOO LATE FOR THE DAILY MAIL RACE, THAT THERE IS USUALLY A SIMPLE ANSWER TO THE MOST COMPLICATED QUESTION
"WHAT'S A SOAP FACTORY DOING HERE?"
SUD
ON THE OTHER SIDE OF THE CHANNEL, THE PARIS AIR SHOW WAS ATTENDED BY KNOWLEDGABLE REPRESENTATIVES FROM ALL OVER THE WORLD
– AND NOW SUD, AIR FRANCE AND ROLLS-ROYCE, BRING US BACK IN THE FASTEST SCHEDULED TIME TO THE LAND WHERE MERGING HAS BECOME A NATIONAL PASTIME –
WESTLAND AND SARO HAVE MERGED, AND THE BEST OF BRITISH LUCK TO THEM.
ALSO, IN THE INTERESTS OF ROTATIONALISATION, THE HELICOPTER ASSOCIATION HAS MERGED WITH THE R.Ae.S.
"IF YOU'D ONLY DRIVEN THEM ON THE ROAD, IT'D NEVER HAVE HAPPENED!" "YOUR DAMNED HOOFS."
THEN THE R.A.F. MERGED WITH THE AIRCRAFT INDUSTRY FOR A DAY'S SOCIABLE GOLF, TO GET AWAY FROM IT ALL.
"MAY I SKETCH YOU, SIR?"
AND THE AIR MINISTRY'S NEW CHIEF INFORMATION OFFICER, A.V.M. 'GUS' (MULOW) WALKER, MERGED WITH THE PRESS.
(PREFERRED IN TYPICAL WORKING POSITION)
AT GATWICK, THE PRESS WERE TREATED TO A DEMONSTRATION OF THE OMINOUS CONWAY RAPIER, ELAND 540'S HIGH SONNOLENCE FACTOR.
OVER IN INDIA, THE GREAT DHOBBY SAHIB DEMONSTRATED THE AVRO 748 TRICK.
NOW THE PRINTERS ARE BACK. BUT THERE ARE CERTAIN P.R.O.'S WHO, WITH THE S.B.A.C. DISPLAY'S PUBLIC DAYS IN APRIL PROSPECT, WOULDN'T HAVE MINDED ANOTHER MONTH'S LAY-OFF
"AW, SHUCKS, POP, THE RADIO WAS WRONG – THAT SHIP'S GOT ALL ITS WHEELS O.K."
ACROSS THE ATLANTIC, BOEING AND SOME OF THE AIRLINES HAVE WISHED RATHER WISTFULLY THAT THEIR OWN PRESS AND RADIO AND TV MIGHT WITH ADVANTAGE CLOSE DOWN DURING CERTAIN TRYING TIMES.
EVER SINCE WE LAST APPEARED, THE HANDLEY PAGE FOREIGN LEGION IN THEIR HERALD HAVE BEEN DARTING IN AND OUT OF IMPOSSIBLE PLACES ALL OVER SOUTH AMERICA.

that subject to members' agreement the Association would be dissolved and its funds and assets transferred to a new Rotorcraft Section of the Royal Aeronautical Society to be constituted and governed according to the Society's accepted Section Rules.

The first committee of this section would, it was agreed, comprise the Association's current executive council. Members of the Association who were not members of the Society would be entitled to apply for membership without payment of an entrance fee.

In effect, the Association's activities would continue under the aegis of the Society. Its pioneering work and its status in the aeronautical world would be recognized by the incorporation of its name in the full title of the R.Ae.S.—subject to the approval of Her Majesty's Privy Council.

These proposals received the formal approval of members of the Helicopter Association on July 10 at an extraordinary general meeting; 139 votes being recorded for the merger and 15 against. The next step towards the disappearance of the Association *per se* is to be taken at a future meeting of its members to approve a resolution that The Helicopter Association of Great Britain, Ltd., should be wound up according to law.

Such is the lively character of the Association that notwithstanding the overwhelming vote in favour of this submergence of one of our younger and more promising learned groups into the oldest aeronautical society in the World, there will be many who will regret its passing.

B.O.A.C. Round the World

A WEEK ago, August 7, President Eisenhower endorsed the final decision of the U.S. Civil Aeronautics Board to permit B.O.A.C.'s traffic rights between San Francisco and Tokyo—thus enabling the Corporation to complete its round-the-World plans. The first twice-weekly service by Britannia 312, via New York, linking up with the eastward Comet 4 services at Hong Kong, will start on August 22.

The battle for Pacific rights has been going on since November, 1958. Initial permission was granted and preliminary services started this spring, but Northwest Airlines objected at the 11th hour. The favourable C.A.B. decision has been awaiting confirmation at the White House since May 18.

The New Authority

PLANS have now been completed by the M.T.C.A. for the setting up of a new central licensing body. If the present Government remains in power after the forthcoming General Election, the necessary legislation is likely to be introduced as soon as possible.

In the House of Commons on July 20, Mr. Watkinson explained that the new body is to be responsible for licensing both operations and the operators themselves. That is to say, it will take over from the A.T.A.C. the job of examining operators' applications for new services or routes, and will assume the Minister's present authority for giving approval to its own recommendations. It will also have the power to examine individual companies and to withhold their operating licences if necessary. This latter provision has long been recommended by B.I.A.T.A., which is anxious to maintain the standards of service and safety of British independent operators.

Westland-Saro Merger

AN extraordinary general meeting of Westland Aircraft, Ltd., has been called for August 17 with a view to increasing the capital of the company to £5,000,000 by the creation of 4,000,000 ordinary shares of 5s. each. Of these new shares 3,200,000 are to be used to buy the issued share capital of Saunders-Roe, Ltd., the acquisition of which was announced by Westlands on July 14. The Hon. H. N. Morgan-Grenville, O.B.E., chairman of Saunders-Roe for the past twelve years and Capt. E. D. Clarke, C.B.E., M.C., its managing director, are to join the Westland board.

The two principal subsidiaries, Saunders-Roe (Anglesey), Ltd., and Saro Laminated Wood Products, Ltd., are to be sold to de Havilland Holdings, Ltd., for £482,000 before Westlands take over. Saro Structures, Ltd., and Saro-Nuclear Enterprises, Ltd., will be retained.

Westlands already have the distinction of being the largest helicopter producing organization in Europe. Saunders-Roe with their production of Skeeters for the armed forces and the promise shown by their turbine-powered P.531 prototypes have a useful part in the rotary-wing business, here and abroad. The large single unit which will result from the integration of these two enterprises will be able to offer a range from the small two-seater to a 40-50 seat civil transport helicopter.

Other important Saunders-Roe activities are their work as main contractors for the R.A.E. Black Knight re-entry research missile and the development under sub-contract of the N.R.D.C.'s experimental Hovercraft. The company also does a sizeable amount of sub-contract work for the aircraft industry; electronic work for missiles and computers; and hydrodynamic research. Thus enlarged Westlands will have an impressive range of aeronautical and astronautical interests.

Mr. Paul Irons, a director and secretary of Saunders-Roe, is resigning to become financial director to the de Havilland Aircraft Co., Ltd. He will succeed Mr. A. Stewart Kennedy who will thus be able to devote more time to the affairs of de Havilland Holdings of which he is financial director; he will, however, remain a director of the aircraft company.

Photograph copyright "The Aeroplane and Astronautics"

CARGO-HANDLING FACILITY.—Using the A.W.A. roller loading system to transfer a Dart power plant from a lorry to an A.W. Argosy. Flight development is now two months ahead of schedule. Five have flown since the maiden flight of the first Argosy last January.

For Aeronautical Historians

ALL should welcome the formation of a Historical Group by the Royal Aeronautical Society. It is to collect, interpret and preserve aeronautical information and material, as well as to present papers on aeronautical history and to initiate historical research. The library of the R.Ae.S. already has an extensive collection of aeronautical documents, but hitherto the Society has had no arrangements for people who are interested in aviation history to meet.

In the past many interesting old aircraft have been lost because no effort has been made to preserve them. In an effort to prevent further losses the Society has formed a register of the historic aircraft which exist in Britain. It includes details of about 120 British and foreign aircraft considered to be of major historic importance and another 67 which are also of historic interest. The owners of these aircraft will be given plaques to be attached to their airframes.

News has also come from the Science Museum of welcome plans for showing the National Aeronautical Collection almost in its entirety.

Heralds for B.E.A.

THE three Dart Heralds which the Ministry of Supply is to purchase from Handley Page will be used by B.E.A. on certain routes in Scotland, where the aerodromes are too small for Viscounts.

The arrangement is that the Heralds will be supplied to B.E.A. for five years. If they are satisfactory, B.E.A. will buy them from the Government at the end of the trial period. The Corporation has no major requirement for this size of aeroplane, but it is hoped that export sales will be encouraged by their use in this way.

The first of the three Heralds, in production at Woodley, is expected to fly in August and will be ready for delivery, with full C. of A., next summer.

News About People

BLACKBURN APPOINTMENT.—Air Cdre. F. R. Banks, C.B., O.B.E., C. G. I. A., F. R. Ae. S., M. I. Mech. E., F.Inst.Pet., Hon.F.I.A.S., has given up his post as the sales director of Bristol Siddeley Engines at his own request for personal reasons and resigned from the board. He joined the boards of the Blackburn Group, Ltd., of Blackburn Aircraft, Ltd., and of Blackburn Engines, Ltd., on August 10.

MILITARY ADVISER.—Brig. G. L. Fitzgerald, C.B.E., D.S.O., has been appointed military adviser to Short Brothers and Harland, Ltd., and will be primarily concerned with the SC.5 Britannic project. He has recently been closely associated with the development of military equipment and weapons for the Army.

R.A.E. APPOINTMENT.—Mr. P. A. Hufton, B.Sc., M.Sc., was appointed head of the aerodynamics department, R.A.E., Farnborough, on July 1 in succession to Mr. L. F. Nicholson. Joining the R.A.E. in 1934, he became superintendent of performance at the A. and A.E.E., Boscombe Down, in 1946. He was appointed superintendent of supersonics at the R.A.E. in 1953; senior superintendent of the aero department, R.A.E., Bedford, in 1956, and since last year has been chief superintendent at Bedford.

D.H. IN INDIA. — Mr. A. K. McLennan has joined the de Havilland Enterprise to supervise in India the affairs of the British and overseas companies of de Havilland and of its associates, the companies of the Saunders-Roe Group. He is based in Delhi and responsible to Mr. Hugh Rice, Far East regional manager.

WOOMERA APPOINTMENT.—Col. R. E. Durance of the Australian Army has been appointed Superintendent of the Woomera Rocket Range. He succeeds Capt. J. B. Newman, R.A.N., who retired from the post on June 30.

M.o.S. APPOINTMENT.—Dr. N. J. L. Megson, M.Sc., F.R.I.C., F.P.I., has been appointed Director of Materials Research and Development (Air) in succession to Dr. H. Sutton, C.B.E., who is retiring. Dr. Megson was born in 1903; he joined the M.o.S. in 1939 and in 1951 became superintendent of the chemistry department, R.A.E., Farnborough.

M.o.D. NEWSMAN.—Mr. S. R. White has been appointed deputy director of public relations to the Ministry of Defence. For some years he has been responsible for Press matters for the U.K. Atomic Energy Authority.

E.B. BOARD MOVES. — Elliott Brothers (London), Ltd. (a subsidiary of Elliott-Automation), announces that as from August 4 Mr. L. Bagrit will be chairman and chief executive, Dr. L. L. Ross managing director, Mr. E. O. Herzfeld deputy managing director and controller, and Mr. G. C. Fairbanks and Cdr. H. Pasley-Tyler, R.N. (Retd.), assistant managing directors. Mr. L. C. Upsdell is now a director and secretary of the company.

Left, Brig. G. L. Fitzgerald, C.B.E., D.S.O., and right, Mr. T. E. Stephenson.

CANADIAN P. & W.—Mr. T. E. Stephenson has been elected president of Canadian Pratt & Whitney Aircraft Co., Ltd., to succeed Mr. R. T. Riley who died suddenly in June. Mr. Stephenson joined the company in 1956, becoming executive vice-president in 1958.

CANADIAN AVRO.—The resignation of Mr. Crawford Gordon, Jr., from his appointment as president and general manager of Avro Aircraft in Canada was announced at the beginning of July. Mr. F. T. Smye and Mr. J. L. Plant have also resigned.

F.E.A.F. APPOINTMENT.—Air Vice-Marshal C. D. Candy, C.B.E., R.A.A.F., has been appointed Senior Air Staff Officer, F.E.A.F., with effect from August 24, 1959. Since 1955, R.A.A.F. personnel have been integrated with the staffs of Headquarters, F.E.A.F., and its No. 224 Group. Under this arrangement the Air Vice-Marshal posts of A.O.C., No. 224 Group, and S.A.S.O., F.E.A.F., are held alternately by R.A.F. and R.A.A.F. officers. Air Vice-Marshal V. E. Hancock, R.A.A.F., recently completed his term of duty as A.O.C., No. 224 Group, and has been succeeded by Air Vice-Marshal R. A. Ramsay Rae.

CELLON NEWS. — Mr. Aubrey Wallace Barr, M.A., a director since 1955, has been appointed assistant to the managing director. His father, Mr. A. J. A. Wallace Barr, founded Cellon in 1911.

AEROFLOT CHIEF.—Persistent ill-health has forced Marshal Zhigarev to retire as chief of Aeroflot. He is succeeded by General E. F. Loginov.

BOSCOMBE CHANGES.—In September, Dr. J. Cameron will take over the post of chief superintendent of A. and A.E.E., Boscombe Down. He succeeds Mr. D. E. Morris, who becomes chief superintendent and head of the aerodynamics division at R.A.E. Bedford. Dr. Cameron has been Director of Atomic Weapons (Plans) at M.o.S. since 1954. Mr. Morris has been chief superintendent at A. and A.E.E. since 1955.

BRISTOL SIDDELEY SALES.—Following the resignation of Air Cdre. Banks from the Bristol Siddeley board, Mr. W. H. Rees has been appointed general sales manager of the company.

Mr. Paul Irons is resigning as director and secretary of Saunders-Roe to become financial director of the de Havilland Aircraft Co., Ltd.

A.T. PROMOTION. — Mr. A. I. Johnson has been appointed general manager of Aviation Traders (Engineering), Ltd. He joined the company from Hunting Percival Aircraft in December, 1955. Aviation Traders recently announced (THE AEROPLANE AND ASTRONAUTICS for June 19) a vehicle ferry replacement aircraft based on the Douglas DC-4.

SOARING PIONEER.—We regret to record the death on July 24 of Wolf Hirth, one of the greatest pioneers of soaring flight. He met his death in a flying accident while testing a sailplane at Teck. Born in 1900, Herr Hirth made his first flight in a home-built glider in 1920 and he had been actively involved with sailplaning ever since.

Air Transport News

BLACKBUSHE TO CLOSE.—After a long period of doubt the Ministry of Transport has decided to close Blackbushe Airport when the majority of the requisition orders lapse at the end of 1960.

QANTAS JET SERVICE.—The first regular Boeing 707 service by Qantas between Sydney and San Francisco, via Fiji and Honolulu, was flown on July 29-30. Three 707s had then been delivered and two more have since made proving/delivery flights over the Atlantic and eastern route.

B.E.A. PROFIT. — An operating surplus of about £1,300,000 and an overall profit, after interest, of about £230,000 will be returned by B.E.A. for 1958-59.

ATC POLICY.—An Air Traffic Control Board is to be set up under an independent chairman to formulate U.K. policy and to co-ordinate work.

TO SOUTH AMERICA.—B.O.A.C. will re-start services to South America on January 25, 1960, with two services a week by Comet 4 to Rio de Janeiro, Montevideo, Buenos Aires and Santiago.

SAFETY COMMITTEE.—A Transport Flight Safety Committee has been formed with membership from the Air Corporations, B.I.A.T.A., the Directorate of Flight Safety of the Air Ministry, R.A.F. Transport Command and the Ministry of Transport and Civil Aviation.

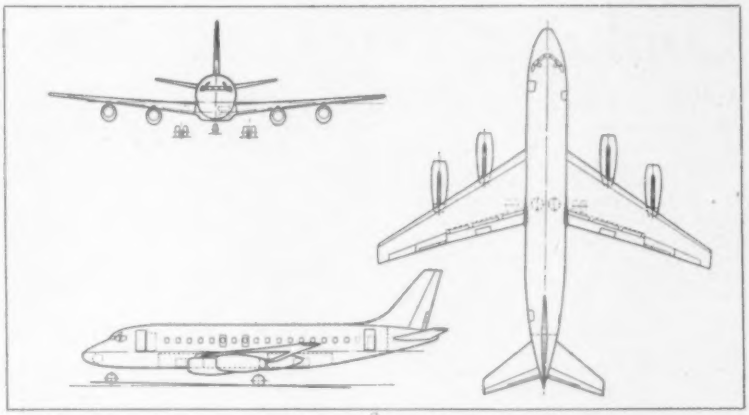
The Douglas DC-9

AFTER more than two years of design study and discussions with the airlines, Douglas Aircraft announced in June the final form of the DC-9 short-medium-haul turbojet which is offered for service in 1963. The basic configuration might be described as that of a scaled-down DC-8, but there are a number of variations in detail and the performance is based on the use of a Pratt & Whitney turbo-fan, or by-pass, engine which is to be capable of maintaining its take-off thrust (8,250 lb.) at sea level up to temperatures of 90° F. (or I.S.A.+17.2° C. at sea level).

One of the more significant statements by Douglas about the DC-9 is that its economics are equivalent to those of the DC-6B, which is probably the most efficient transport aircraft on the air routes. The range limits of the DC-9 are, in fact, very similar to those of the DC-6B, and it will have a similar maximum payload, but its block speeds are 340 to 450 knots according to sector distance. Its sea-level take-off distances are comparable with those of the 6B. With 68 first-class passengers the quoted direct costs vary between 2.03 and 1.5 U.S. cents per passenger-mile according to stage-distance. The higher figure applies to 300 naut. mi. and the lower figure to 2,150 naut. mi. stages.

In order to improve the airfield performance, the DC-9 will have leading-edge slats which are mechanically interconnected with the flaps. The maximum landing weight is 13,000 lb. more than that with a full first-class payload and normal fuel reserves, so it will be possible to operate over many route sectors without refuelling. For quick turn-rounds there will be a self-contained stairway at the forward passenger entrance.

The JTF-10A-1 engine may be related to the 7,500-lb.s.t. JT8 (J52)—a two-spool engine designed for the U.S. Navy. Douglas claim that the specific consumption will be about 10% less than that of normal turbojet engines of the same take-off power.



Dimensions
- Span: 94 ft.
- Overall length: 103 ft.
- Overall height: 34 ft.
- Gross wing area: 1,285 sq. ft.
- Sweepback: 30° at 25% M.A.C.
- Internal cabin dimensions:
  - Length (ex. flight deck): 71 ft.
  - Max. width: 124 in.
  - Max. height: 81 in.

Accommodation
- De luxe: 68 passengers.
- Max. coach: 92 passengers.
- Volume of freight and baggage holds: 609 cu. ft.

Powerplants
- Four Pratt & Whitney JTF-10A-1 (turbo-fans).
- Take-off power each (I.S.A. to I.S.A. + 17.2°C., s.l.): 8,250 lb.s.t.

Weights and Loadings
- Mfrs. max. payload: 20,355 lt.
- Max. take-off: 120,000 lb.
- Max. landing: 98,000 lb.
- Max. zero fuel: 87,000 lb.
- Wing loading (max. t.-o.wt.): 93.3 lb./sq. ft.
- Wing loading (max. landing wt.): 76.2 lb./sq. ft.
- Power loading (max. t.-o.wt.): 3.6 lb./lb.s.t.

Performance
- Cont. cruising speed (I.S.A.): 480 knots (at 35,000 ft. and mean weight).
- F.A.A. t.o. field lengths (at max. wt.):
  - I.S.A. sea level: 5,950 ft.
  - I.S.A.+22.8°C.: 6,840 ft.
- F.A.A. landing distance (max. landing weight, I.S.A., sea level): 4,800 ft.
- Max. range: 2,250 naut. mi.

Birthday Honours

KNIGHTHOOD

Leslie Carr Gamage, M.A., M.C., F.C.I.S., chairman and managing director, General Electric Co., Ltd.

ORDER OF THE BATH

Knight Commander (Civil)

W. Strath, C.B., Permanent Secretary, Ministry of Supply.

Knights Commanders (Military)

Acting Air Marshal W. G. Cheshire, C.B., C.B.E.; Acting Air Marshal K. B. B. Cross, C.B., C.B.E., D.S.O., D.F.C.

Companions (Military)

The Venerable F. W. Cocks, M.A., Q.H.C.; Air Vice-Marshal G. A. Walker, C.B.E., D.S.O., D.F.C., A.F.C., M.A.; Air Commodores G. C. Bladon, C.B.E., R.A.F. (Retd.); H. Ford, C.B.E., A.F.C.; C. E. S. Lockett, R.A.F. (Retd.); C. J. Salmon, O.B.E.; J. E. R. Sowman, C.B.E.; R. B. Thomson, D.S.O., D.F.C.; Acting Air Commodore P. G. Jameson, D.S.O., D.F.C.; Group Captain A. H. Humphrey, O.B.E., D.F.C., A.F.C.

ORDER OF SAINT MICHAEL AND SAINT GEORGE

Companions

W. H. Wheeler, lately Head of U.K. M.o.S. Staff, Melbourne, (now Director of Explosives, Research Establishment, M.o.S.).

ROYAL VICTORIAN ORDER

Member—Fourth Class

Wg. Cdr. D. F. Hyland-Smith, D.F.C., A.F.C.

Member—Fifth Class

Flt. Lt. W. G. McCready.

ORDER OF THE BRITISH EMPIRE

Knight Grand Cross (Military)

Air Chief Marshal Sir Claude B. R. Pelly, K.C.B., C.B.E., M.C., A.D.C.

Knight Commander (Civil)

Prof. Sir David Brunt, for services in the organization of the International Geophysical Year.

Knights Commanders (Military)

Air Vice-Marshal L. Dalton-Morris, C.B., C.B.E.; Air Vice-Marshal F. W. P. Dixon, C.B.E., M.B., B.S., F.R.C.S., F.R.C.S. (Edin.), D.O. (Oxon), Q.H.S.

Commanders (Civil)

Prof. W. J. G. Beynon, for services in the organization of the International Geophysical Year; Gp. Capt. G. R. Scott-Farnie, managing director, International Aeradio, Ltd.; W. R. Hawthorne, professor of applied thermodynamics, University of Cambridge; J. F. McGlennon, O.B.E., assistant secretary, Air Ministry; E. C. Wheeldon, managing director, Westland Aircraft, Ltd.

Commanders (Military)

Air Commodore J. S. Wilson, M.B., Ch.B., D.P.H. Group Captains L. E. Botting, D.F.C.; R. J. Clare-Hunt; The Rev. T. Hankin, B.A. Group Captains I. G. S. Hemming, O.B.E.; E. Knowles, M.B.E., A.D.C., B.Sc., A.F.R.Ae.S.; A. E. Lowe, M.B.E., D.F.C.; D. Lumgair; S. E. D. Mills, A.C.A.; S. L. Ring, D.F.C.; E. W. Tacon, D.S.O., M.V.O., D.F.C., A.F.C.

Officers (Civil)

C. W. Andrews, Deputy Chief Lands Officer, Air Ministry; G. R. Bryce, chief test pilot, Vickers-Armstrongs (Aircraft), Ltd.; G. F. Clarke, Senior Principal Scientific Officer, R.A.E.; E. J. Dickie, M.B.E., Deputy Director Operations, Civil Aviation Control and Navigation Directorate, M.T.C.A.; K. O. Grant, Assistant Director of Aircraft Equipment Production, M.o.S.; H. B. Irving, chairman, Noise Research Committee, Aeronautical Research Council; J. MacDowall, for services in charge of the I.G.Y. programme at the Royal Society Base, Halley Bay; W. H. Parsons, M.V.O., Principal, Air Ministry; J. E. Pennifold, M.B.E., Senior Chief Executive Officer, Air Ministry; J. C. Sharman, manager, Research and Development Division, Garringtons, Ltd.; W. A. J. Thorn, Deputy Director, Telecommunications, M.T.C.A.

Officers (Military)

Wing Commanders J. Cassell; K. E. Christensen; J. O. Dalley, D.F.M.; (Acting Group Captain) E. Earnshaw, A.M.Inst.Mun.E.; G. Goodman, M.B.E., D.F.C.; G. Hampton, D.F.C.; T. B. Jones; W. H. Kearney; N. S. Petch; C. E. P. Suttle, B.Sc., A.M.I.E.E.; A. R. M. Watts, B.A.; C. H. Wiggins, F.C.C.S. Acting Wing Commanders A. McKinlay, A.M.I.Mech.E., A.M.I.E.E.; P. D. G. V. Whittingham, M.D., B.S. Squadron Leaders R. W. Clark; J. H. Cooke; D. F. Miller, D.F.C.; C. E. Ness; H. Neubroch; W. N. Perioli, D.F.C.

Looking Back at the Paris Show

ALTHOUGH it would be nonsense to say that the American exhibits stole the Show at Paris this year, those organized by the U.S.A.F. and the U.S. Army certainly overshadowed everything else in the factual, as well as the metaphorical, sense.

The factual effect lay in what can only be described as the Manhattan skyline of missiles, real or imitation, with Atlas, the Moon-probe Thor and Redstone dominating the delightfully under-stated (*fusée*) area behind the main exhibition building. The metaphorical overshadowing was less marked, but one could not fail to be impressed by the number of operational U.S. aircraft on the apron and the way in which these were flown in, to a routine, by U.S.A.F. crews and parked in their allotted places as a matter of natural course. Amongst them were four Century-class fighters in service—the F-100 Super Sabre, the F-101 Voodoo, the F-102 Delta Dagger and a two-seat F-104 Starfighter.

Nevertheless, the new aircraft were, for the most part, from the French industry, and characteristically, so far as the recent history of the Salon is concerned, helicopters and light aircraft formed the bulk of the "live" exhibits. There were nearly a dozen helicopters of new or near-new design and, of the score or so of private, executive and training aircraft, about half a dozen were being seen for the first time in public. New helicopters included the three-Turmo-engined S.E. 3200 Frelon, the Vertol 107, the Sikorsky S-62—splashing daily in the little artificial pool constructed in the demonstration area—and, for the final days, the Westminster and the Rotodyne.

The Russians provided the most interesting of the transport exhibits—with an Ilyushin Il-18 turboprop transport which, with a Tu-104B, stood in the exhibition park throughout the week, alongside the C-133, the C-130 and a Boeing VC-137A, alias 707. And, for the final week-end, came the World's biggest turboprop transport—the Tu-114—to add to the impact.

The Riddle-styled Armstrong-Whitworth Argosy—loading and unloading day by day outside the "front door" of the exhibition building—was making its first international appearance; and the twin-Bastan-powered Marcel Dassault Communauté and the Max Holste 250 Super Broussard flew only a few weeks before the Show. The Bréguet 940 Intégral research prototype appeared in time to fly.

New powerplants in the indoor exhibition showed the trend towards the turbofan type of engine and the way in which the turbine has been breaking into the small-power field which had, until a few years ago, been held by the piston engine.

The U.S.A.F. had, in addition to the various devices to be seen on the missile site, a separate space-age exhibition in a nearby hangar. This—ingeniously contrived with comparatively little material and dominated by a mock-up of the X-15—with its concentration on the space-science side of the missile business, took the visitors' minds off the more drastic reasons for the existence of weapons like Thor and Atlas.

More than 300 aircraft, including 90 prototypes, took part in the flying display programme according to the organizers. The last week-end at Le Bourget certainly provided one of the most exhausting displays within memory. The 110 items in the programme started each day at 09.40 in the morning and continued, with a 1½-hr. midday break, until 18.40 hrs.

This was far beyond saturation point for most people, with the result that many of the display items did not receive the attention they deserved. The organizers in Paris might well take a cue from the S.B.A.C. show and make use of the group presentation technique for many of the less dramatic aircraft.

Drama was in any case not particularly apparent in the display, which was almost entirely subsonic, and contained more of technical interest than spectacle. Pride of place, it was generally agreed, among the individual demonstrations, went to the Swedish SAAB Draken double-delta fighter, which was superbly flown by test pilot C. Utterborn. The extremely small volume of space occupied by this M=1.8 interceptor in all its evolutions from afterburning take-off to tail-parachute landing was a revelation, and the combination of speed, manœuvrability and slow handling was unmatched by any other aircraft in the display. This impression was gained despite a full Beamont presentation of the English Electric Lightning, with all that implies, probably because of the unfamiliarity and therefore fresh impact of the Swedish delta's outline.

Another new shape was the distinctive blend of angularity and rotundity encompassed in the Blackburn N.A.39. Derek Whitehead presented it at a typical operational altitude on its first public appearance, flashing over the runway at about 50 ft. in a rock-steady run, after a blown-flap and drooped aileron take-off. He also showed the rapid rate of roll of the N.A.39, which was displayed statically for a short time before the flying programme.

Technical novelty was represented by the STOL Bréguet 940 and the ramjet Nord Griffon II. The Br. 940, which operates on the flap-deflected slipstream principle, took off in 75 yards and landed in 50. It has been tested so far to flap deflections of 80° on the inboard sections and 55° on the outer, and its pilots say that it is as easy to fly as a Piper Cub. The Griffon II, at the other end of the speed scale, ignited its turboramjet in the air with an enormous spear of orange flame, and Harmon Trophy winner Andre Turcat showed its spectacular climb.

Having recently made its initial flight, the Mirage IV "atom" bomber appeared briefly in the air over Le Bourget, showing its scaled-up dimensions compared with the accompanying Mirage IIIAs, while another of the latter small fighters was flown with its S.E.P.R. 841 rocket of 3,300 lb. thrust.

Everyone wished that the mammoth Tu-114 had been shown in the air, but the U.S.S.R. was well represented in the display by the quiet Ilyushin Il-18 and the noisy Tu-104B.

Although the Mystère IVs of the Patrouille de France made particularly effective use of coloured smoke in their formation aerobatics, it is satisfying to record that a generally unexciting display ended on the magnificent crescendo of No. 111 Squadron R.A.F.'s superb full-squadron show with their Hunters.

The SAAB Draken

Paris Show Report . . . .

Military Aircraft at the Salon

A DOMINANT feature of the scene in the static park at Le Bourget was the American contribution of military aircraft. Four of the Century-series fighters were on view and the giant C-133 transport dwarfed all other aircraft present. In nearly every case the U.S.A.F. types shown were operational aircraft which had flown to Paris from their bases in Europe or overseas and none appeared to have been treated to the "window-dressing" of a new coat of paint or the super-gloss polish that most manufacturers give their aircraft before a show of this kind; they were, in fact, presented as hardworking squadron aircraft.

Many of the military aircraft to be displayed were scheduled only for the flying demonstrations during the last week-end of the show—and this applied particularly to Britain's bombers and fighters. In this brief survey we propose to include only those aircraft displayed statically during the first week-end of the Salon; the interesting new military transports and helicopters on view are discussed elsewhere in this issue.

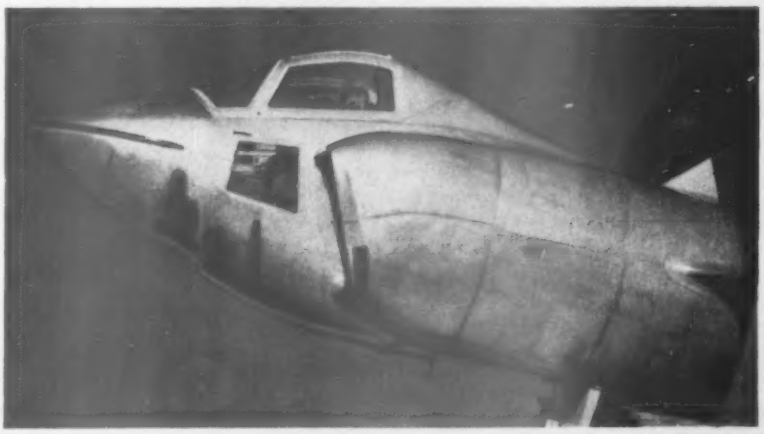
Inevitably, some of the most interesting aircraft expected at Le Bourget were not present at the beginning of the show. The biggest disappointment to early visitors was probably the absence of the SNECMA Coleopter—not strictly a military aircraft, but one which may have important military applications in future. This annular-winged research aircraft first flew on May 6 this year; its predecessor, the Flying Atar, was a highlight of the show two years ago.

Powered by an Atar E 5V of 8,150 lb. thrust, the Coleopter weighs about 6,600 lb. at take-off. It is controlled by the deflection of its main jet efflux during its vertical take-off and landing; after conversion to horizontal flight four swivelling tail fins are used for normal aerodynamic control. A retractable foreplane assists the transition from vertical to horizontal flight.

Another important French "absentee" was the Dassault Mirage 4, the prototype from which a Mach-2 bomber will be derived. This new supersonic bomber is planned to form the basis of a French nuclear bomber force; production aircraft will be powered by two Pratt & Whitney J 75s built under licence by SNECMA.

The non-arrival of a Republic F-105 Thunderchief disappointed the U.S.A.F. personnel at Le Bourget, but its absence can hardly have been noticed by the average visitor, who could inspect an F-100 Super Sabre, a McDonnel RF-101 Voodoo, a Convair F-102 Delta Dagger all-weather interceptor, and a Lockheed F-104 B—the two-seat trainer version of the F-104 Starfighter which has held both the World's speed and altitude records since May, 1958.

An interesting comparison could be made with the British, American and Swedish delta-winged all-weather fighters on view. Largest of these, and the only twin-engined one, was the Javelin 7 of No. 25 Squadron, R.A.F., armed with four D.H. Firestreak air-to-air missiles. Obviously of advanced design and performance were the two single-seat deltas, the Convair F-102 of the U.S.A.F. and Sweden's Saab 35A Draken with its "double-delta" planform. Javelin development has



NAVAL VERSATILITY.—Top, surrounded by alternative armament loads is the Dassault Etendard 4M, which is in production as a fighter and strike aircraft for the new French carriers "Clemenceau" and "Foch."

COLEOPTER CLOSE-UP.—Right, a retractable foreplane—here seen in the closed position—assists transition of this SNECMA VTOL research aircraft from vertical to horizontal flight and vice versa.

Photographs copyright "The Aeroplane and Astronautics"

THE AEROPLANE
and ASTRONAUTICS

U.S.A.F. TRAINER.—Nearly 350 Cessna T-37 jet trainers are in service with the U.S.A.F. Powered by two 920-lb.-s.t. Continental J69s it has a maximum speed of 373 m.p.h. and endurance of 3 hrs. 25 min.

ALL-WEATHER INTERCEPTOR.—The Swedish Saab 35A Draken is capable of Mach 1.8; the 35B version of this aircraft will exceed Mach 2. An unusual feature is the fin-like antenna ahead of the actual fin.

Photographs copyright "The Aeroplane and Astronautics"

ended, but the Convair F-106 interceptor has evolved from the F-102 and the Saab 35B version of the Draken is under development as a Mach-2+ fighter.

Both the Javelin and the Draken have cannon armament as well as infra-red air-to-air missiles, but the most powerfully armed of the three is the Delta Dagger F-102. A model exhibited by Hughes showed how the F-102 carries simultaneously three GAR-1D Falcon semi-active homing missiles, three GAR-2A Falcons with infra-red homing and a battery of unguided rockets which are fired from its weapon-bay doors.

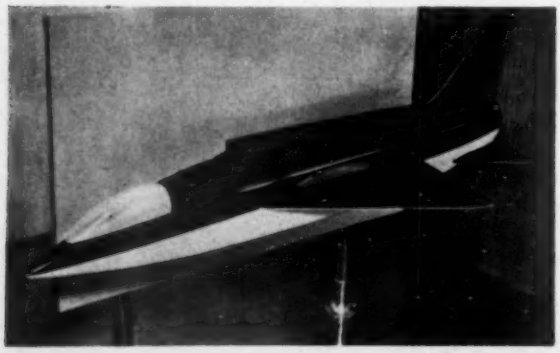
Saab also displayed its 35B Lansen two-seat all-weather fighter. This aircraft, of earlier design than the Draken, was originally developed for ground-attack duties. The Draken and the Lansen represent formidable achievements by the small Swedish aircraft industry (details of their development were given in THE AEROPLANE AND ASTRONAUTICS for June 12).

A French all-weather fighter on show was the Dassault Mirage 3A, a development aircraft leading to the Mirage 3C, of which 100 are on order. It is a Mach-2 aircraft powered by an afterburning Atar 9 turbojet plus a SEPR 841 rocket pack. The Mirage 3B, a two-seat tandem trainer version of this aircraft, was displayed inside the static exhibition on the Dassault stand.

Jet trainers formed the largest group of aircraft in the static park. They ranged from comparatively simple and light *ab initio* trainers such as the Miles Student to the potent Mach-2 Lockheed F-104 B. This F-104 flew regularly and was a centre of attraction to the onlookers—as much for its appearance on the ground as for its performance in the air. Its thin anhedral wing measures only 7 ft. 6 in. from the fuselage side to the tip and its leading edge, although not of proverbial razor sharpness, is certainly sharp enough to need the wooden protective strips which the ground crew attach as soon as the aircraft has taxied in after a flight.

Lower down the trainer performance scale were the two-seat Hawker Hunter, which is in widespread service, and the new Macchi MB 326, a tandem jet trainer powered by a Bristol Siddeley Viper 11. Also displayed were the well-known Fouga Magister and—for the first time in Europe—the Cessna T-37.

This Cessna side-by-side jet trainer has been produced in large numbers for the U.S.A.F., which will probably use it for *ab initio* all-jet training in future. An interesting feature of this aircraft is the wide strake on each side of its fuselage nose which was introduced to assist spin recovery; the aircraft has an unlimited clearance for spinning.



SHORT MODEL.—This is one of several studies by Short Bros. and Harland for a lightweight VTOL fighter and ground-support aircraft..

Both the first- and the second-generation NATO light fighters were on view. These are the Fiat G.91 and the Breguet Taon, which has been chosen as its successor. Despite NATO's official blessing, however, it is said that there is little future for the Taon because of the progress being made with the design of a VTOL third-generation light fighter and ground support aircraft for NATO.

There was little evidence of this third-generation aircraft inside the static exhibition except on the Shorts' stand, where a model was exhibited of a "hypothetical VTOL/STOL lightweight strike fighter intended mainly for ground attack duties." This project follows the Short SC 1 principle, having the identical stabilization system and eight vertically-mounted engines, with main propulsion by a turbofan with afterburner—presumably the new BE 53. The aircraft would travel at Mach 0.98 at sea-level and be supersonic at altitude. It could carry a one-ton payload over a 250-mile radius of action, operating all the way at low altitude.

There was no sign of any models or illustrations of Hawker's VTOL project—the P1127 lightweight fighter—nor was any detailed information on it available. This has been announced as a private venture on the part of the company and it has been said to have a special Bristol powerplant—which is more than likely the BE 53.

Continental aircraft companies are also working on VTOL designs for NATO.

U.S.A.F. reconnaissance types which showed the importance now attached to this rôle were the RF-101 Voodoo and a Douglas RB-66. The former was based at Laon in France and the latter came from Spangdalhem Air Base near Trier in Germany.

Among the French military aircraft on view was a Sud Vautour; 110 of these aircraft have now been built in three versions as a bomber, an all-weather fighter and as a tactical-support aircraft. Two French naval aircraft exhibited were the Breguet Alizé and the new Dassault Etendard 4M, an interceptor and strike aircraft for two new French aircraft carriers "Clemenceau" and "Foch."

Small army-support aircraft were represented by the Morane Saulnier Epervier, a two-seat monoplane powered by a Turbomeca Bastan, and the Nord 3400 artillery-observation aircraft.

In point of fact, with regard to the French exhibits as a whole one came away with the impression that France has some very effective military aircraft in full production. The days when Paris shows were renowned for their fanciful *maquettes* and unlikely prototypes now belong firmly to history.—J.R.C.

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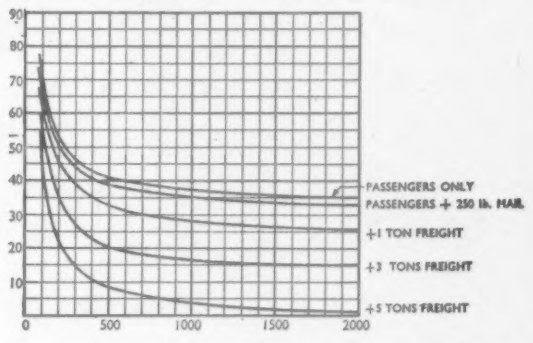
BREAK EVEN NEED—CURRENT TOURIST RATE



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Paris Show Report . . . .

Transport Aircraft on Show

The prototype M.H.250 Super Broussard is piston-engined; later versions will have turboprops—either Turboméca Bastan, Bristol Siddeley P182s, or Lycoming T53s.

THE simplest way of summarizing the prospective airline and military transport aircraft at this year's Paris Salon is to break the exhibits down under three headings: the prototypes or those aircraft or variants which have made their first flights since the beginning of the year; the aircraft which are "new" so far as the majority of the visitors to the Salon are concerned; and the projects which are shown in model or similar form, but which are under active development.

In the first category there were only two—the M.H.250 Super Broussard and the Dassault M.D.415 Communauté.

The Super Broussard, which flew only a few weeks before the opening of the Salon, is a piston-engined (Pratt & Whitney) prototype for the turboprop-powered M.H.260/270/280s of later prospect. There are, in fact, three possible versions, one with Turboméca Bastan, one with Bristol Siddeley P182s, and another with Lycoming T53s. With the Bastans the 260 will have a gross weight of about 17,000 lb., a 50-ft. take-off distance, at this weight, of 1,345 ft. (or 2,500 ft. to SR-422A) and a range of 620 miles with a holding allowance of 45 minutes.

As laid out for the Show, the Super Broussard was fitted with 14 seats in three-abreast rows. It is a fairly conventional high-wing design with a roomy fuselage of approximately square section. The main units of the tricycle undercarriage are retracted into fuselage pannier fairings.

The M.D.415, a low-wing aircraft with two Turboméca Bastan turboprops, has possible commercial applications, but is primarily a military pilot/navigation/bombing trainer and communications type designed for operation from unprepared strips. On liaison duties it carries 10 passengers and a crew of two at about 270 knots over ranges up to 1,350 n.m.

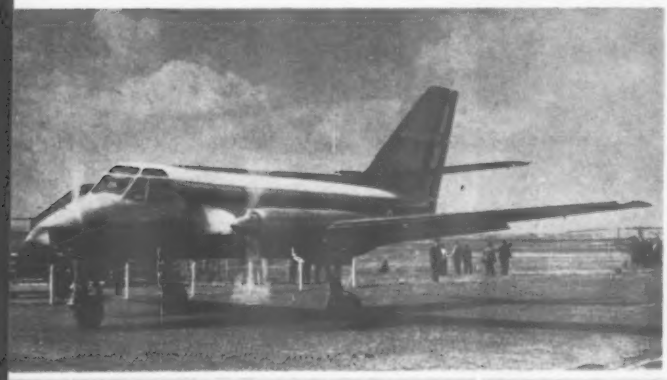
New to the Show, and on view in the full-scale flesh, were an Armstrong Whitworth Argosy, the Agusta A.Z. 8, the Boeing VC-137A (707), a Breguet 765 Sahara, a Douglas C-133A, an Ilyushin 18 and the Tu-104B. The Breguet 940 Intégral prototype, the Britannia 250 series and the Vickers Vanguard were on show later, as was the Tu-114.

Emphasis for the A.W. Argosy (in Riddle Airline's markings) was placed on the continued, day-to-day, demonstration of advanced methods of cargo loading and unloading. And, since the aircraft was parked just outside the main exhibition hall, these vigorous demonstrations must have made a useful impact.

Two methods were shown—the pallet and roller conveyor system developed by A.W.A. and the Cargon system. Either method permits a loading rate of between 3,000 and 4,000 lb. per minute and total turn-round times of the order of 30 minutes, including refuelling. The use of pre-loaded pallets involves a sacrifice of no more than 5% of the total payload and is obviously worthwhile over short and medium stages where turn-round time is at a premium.

For the roller conveyor system, light-alloy rollers are fitted in the aircraft floor—four rows over the whole length of the hold—and the flat pallet, also of light alloy with tie-down rings, is restrained in the aircraft hold by means of guide rails

(*Continued on page 12*)



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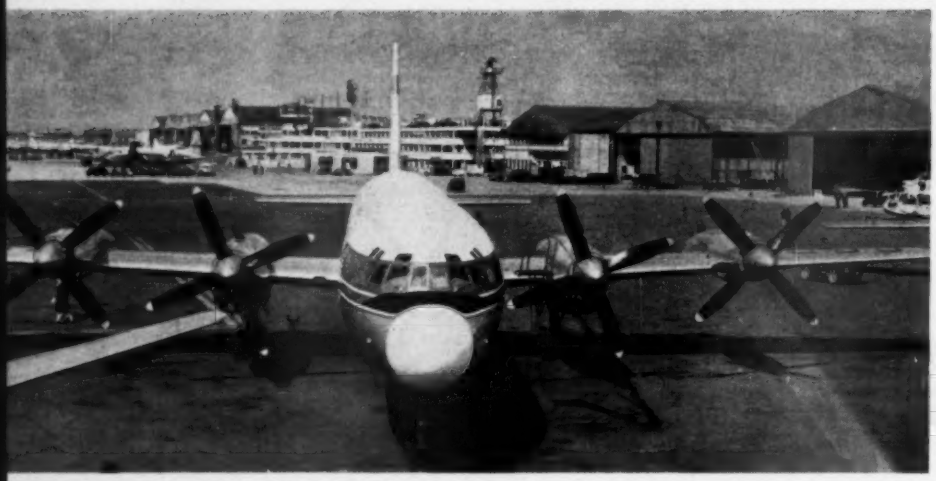
Left is the little Dassault M.D.415 twin-Bastan-engined military communications and training aircraft which made its first flight in May. Below is the Douglas C-133A transport which dominated the exhibition park.

Left, the Nord Griffon II, powered by a turbo-ramjet has an unusual layout which attracted a good deal of attention at Le Bourget.

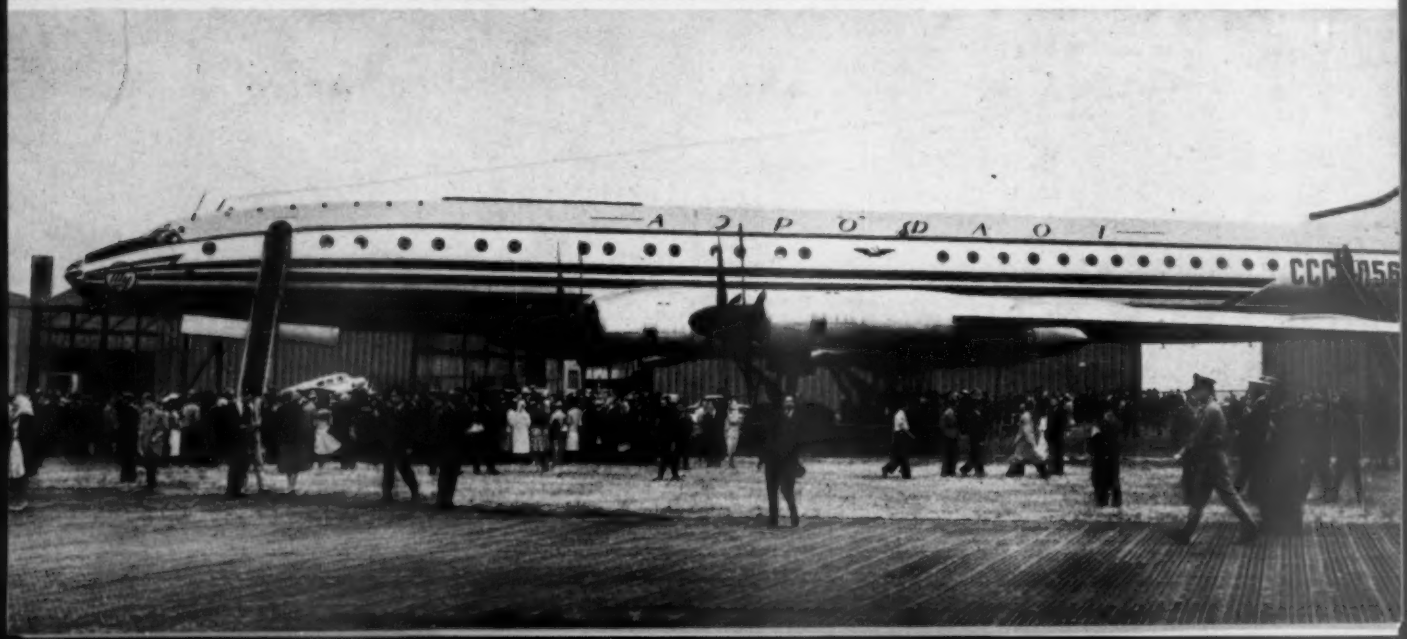
Two prototypes of the lightweight Dassault Etendard IVM shipborne fighter were flown at Paris, the second, seen (right) landing with flaps, drooping leading-edges and air brakes extended, has AIDA all-weather and fire-control radar and a fully-retracting arrester hook.

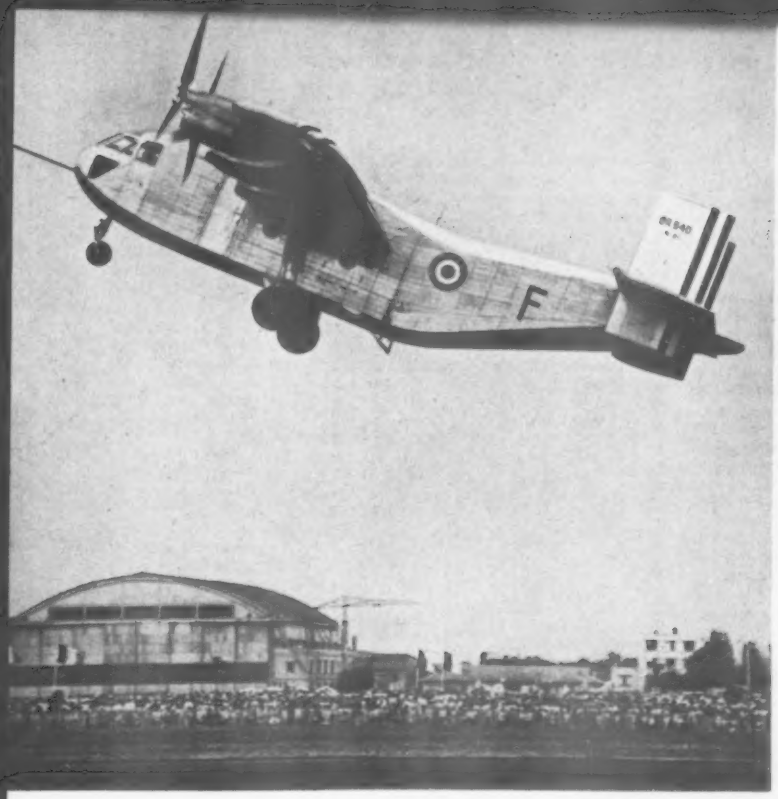


Paris Show Report . .

Newcomers

Left, among the visiting transport aircraft, Russia's flot livery. Below, the arrival of the Tu-114 pro occasion on which the World's biggest transport Curtain.





Above, this attractive light aeroplane with remarkable visibility — the Morane Saulnier M.S. 880—was on show for the first time.

Below, the S.E. 3200 Frelon, largest of French helicopters, is powered by three Turmo shaft-turbines mounted above the fuselage. The S.E. 3200 prototype first flew on June 10.

Above, the prototype Breguet 940 Intégral demonstrates its deflected-slipstream-lift take-off and climb performance. It has four Turmo 2 turboprops; the production 941 will have D.H. Gnomes.

at Le Bourget

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rboprop-powered Il-18 was in Aero-
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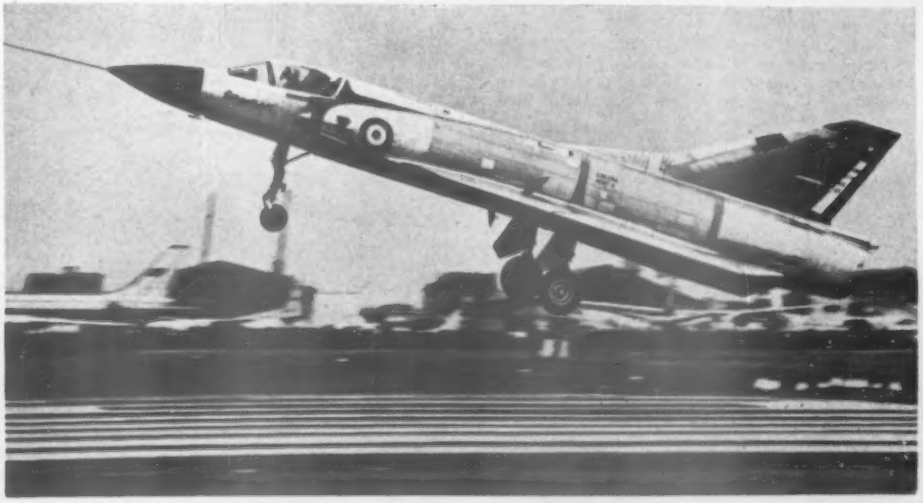
raft emerged from behind the Iron



The first and fifth prototypes (seen above) of the eight Dassault Mirage IIIA M=2 interceptors being built for l'Armée de l'Air were flown at Le Bourget, while others of the series demonstrated the S.E.P.R. auxiliary rocket and accompanied the Mirage IV bomber in a fly-past.

(*Continued from page 9*)

and end stops. The normal sill height of the Argosy is about 4 ft. above ground level—that of a standard truck—and the inevitable variations, as weight is transferred between aircraft and truck, are taken up by means of bridge ramps if adjustable-height vehicles are not available.

The Cargon system, which was originally developed for New Zealand's S.A.F.E. operations over the Straits, operates on a similar principle. The Cargon, in this case, is fitted with wheels which move over flush runners in the aircraft floor. A special hydraulically adjustable conveyor can be used to transfer the Cargon when truck/aircraft sill heights are widely varying. This system, incidentally, was also being demonstrated with the Nord Noratlas in the aircraft park.

The Boeing 707-120 is familiar enough at Le Bourget, but the M.A.T.S. Special Air Mission version in the exhibition park showed what could be done when airline economics do not need to be considered. This VC-137A, the first of three, is a convertible freighter-passenger transport and is normally fitted out with a forward communications and teletype compartment, a central headquarters lounge and a normal passenger cabin at the rear. The version shown at Le Bourget was nothing if not V.I.P., with a 28-passenger Pullman-tabled rear compartment, a luxurious central lounge and a rear galley with elaborate cooking arrangements. Nose and tail have brilliant orange anti-collision styling.

The 282,000-lb. Douglas C-133A dominated the park, and the maintenance of a maximum differential of 6.5 p.s.i. for the cathedral-like hold must have been quite an engineering feat with the enormous rear-loading clam-type and port-side loading doors. This is probably the only operational aircraft using T-34 turboprops. On the "top-floor" flight deck there are rest quarters for the normal crew of two pilots, two flight engineers and two loadmasters; a navigator is carried only on over-water flights.

Two of the Russian transports on show—the Il-18 and the Tu-104B—were open to the public, but the Il-18, new to Le Bourget, attracted the greater interest. This four-AI-20-turboprop transport is, in interior décor, almost indistinguishable from a Western aircraft of the same class and its structural finish is impeccable. As exhibited, it was laid out for 80 tourist (or economy) passengers, with an aft 65-seat cabin separated by a galley and cloakroom from a forward 15-seat cabin.

Light, though somewhat too striking, colours are used throughout, and the control cabin followed suit, with a light grey dashboard which, after years of funereal black, has come into fashion. The flight deck is laid out for two pilots, a radio operator and navigator, with a storm-warning radar display between the two pilots' positions. Performance figures offered included a full-tank range, with one hour's reserve, of 3,100 miles.

The interior of the Tu-104B, with its 100 passenger seats in four compartments, has also been lightened in tone. Although the fittings retained the atmosphere of the Bournemouth Belle, a cream ceiling and light-coloured general décor made the interior a good deal less gloomy than that of the earlier aircraft of this type which have been seen. The two rear toilets were really palatial and the general effect was marred only by the passenger oxygen system, for which tubes trailed like octopus tentacles at every seat position.

Other transport aircraft new to the Salon were the 119,000-lb. Breguet 765 Sahara (a military freighter development of the familiar Deux Ponts), which made its first flight last September; the Bristol Britannia 250 series, two of which (a 253 and a 252) were shown during the second week, one by the R.A.F. on the medical day, and one by the manufacturers during the week-end; and the Vickers Vanguard.

Of transport aircraft for the future, the most significant, in its own field, was the Breguet 941, which has still to be ordered, though the figures obtained with the prototype 940 Intégral have apparently been encouraging and Breguet expect to get a pre-production order for the 941, a fuselage mock-up of which was shown. The prototype Intégral is powered by four Turmo 2s and has been flying since May last year to test the principle of airflow lift. The production aircraft, the first of which should be flying next year, will be powered by four D.H. Gnomes (T-58s).

The mock-up of the 941 fuselage was shown with a variety of accommodation, including passenger and troop-carrying seats and stretchers. As an airline aircraft (B.E.A. is believed to be interested) it can take 48-50 passengers and as a freighter its maximum payload is 11,000 lb. The latest figures, based on work with the Intégral, give the 941 a take-off distance of 720 ft. to clear a 35-ft. screen at a weight of 42,000 lb.

Two new transport projects were shown in model form by Hurel Dubois and Nord—the H.D.37 and the C-160. The first is a twin-Dart (R.Da.7 Mk. 527) vehicle-ferry development of the H.D.34 and Silver City is believed to be more than usually interested in it. It has a deep fuselage providing two floors, the lower one with a length sufficient for three normal-sized or four small cars and the upper one with a 24-passenger compartment aft of the wing and a one-car compartment forward. This floor is raised by electric hoist after loading at lower-floor level. The gross weight of the H.D.37 will be 51,000 lb. and the payload about 21,000 lb.

The Nord C-160 is a twin-Tyne high-wing freighter and paratrooper of 90,000 lb. and is the prospective result of an association of Nord-Aviation with three German manufacturers led by Weser-Flugzeugbau.

British aircraft for the future included the Avro 748 branch-liner and the Short Britannic S.C.5. The Britannic dimensions and weights have been increased since the aircraft was described in our issue of April 10. It now has a span of 158 ft. 9½ in., and a length of 136 ft. 5 in.; the gross weight is 218,000 lb.—or 23,000 lb. greater—and the maximum payload is now 85,000 lb.

New Helicopters

Some half a dozen new helicopters were to be seen at Le Bourget, including the Vertol 107, the Sikorsky S-62, the S.E.3200 Frelon, the Alouette 3 and (in very real-life mock-up form) the Sikorsky S-61.

The 107 twin-rotor helicopter is powered, as a prototype, with two Lycoming T-53 turbines, but later operational versions will have General Electric T-58s. They are housed in the aft rotor pylon, so the passenger compartment is unusually quiet.

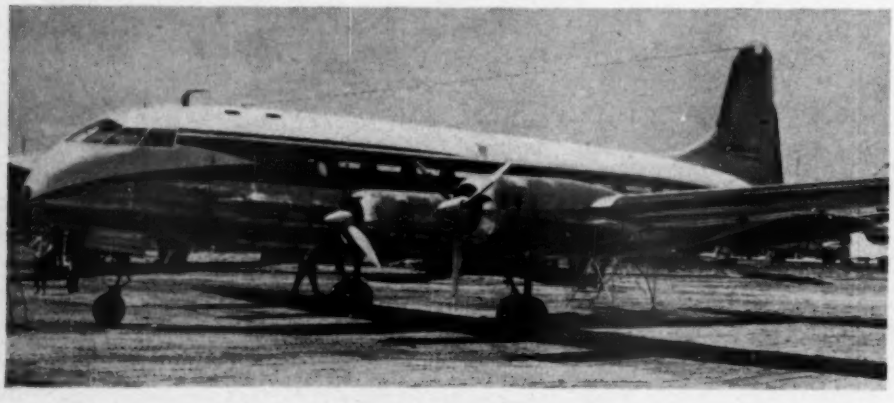
Amphibious, the Sikorsky S-62 spent much of its time splashing quietly in and out of an artificial pool in the helicopter flying area. It is a 10-seat aircraft with a T-58 turbine.

The S.E.3200 Frelon (or Hornet) is the biggest helicopter yet produced by the French industry and made its first flight on June 10. It is a 17,640-lb., 20-24-passenger aircraft with conventional layout and powered by three Turmo 3Bs. The second prototype was on show.

The extremely successful S.E.3130 Alouette appeared in its Mark 3 (3160) form with seven seats (three-four-abreast) and powered by an Artouste 3B.

A prototype S-61 is due to fly next year. This, apart from the S-60 weight-lifter, will be the largest of the Sikorsky family so far. The mock-up at Le Bourget was near enough to being the real thing for visitors to believe it to be real. It was laid out with 22 passenger seats and will have three T-58s.

Other new helicopters were the 10-seat Agusta-Bell 102 (P. & W. R-1340), the Bell HU-1A (T-53), the Hughes YHO-2HU two-seater, the German Bölkow-Entwicklungen Bö-103 single-seat trainer and the Autogiro-type Girhel.



ANGLO-ITALIAN.— Seen for the first time at Le Bourget — the Agusta A.Z.8 medium transport, with four Alvis Leonides.

Photograph copyright "The Aeroplane and Astronautics"

Paris Show Report . . . .

Powerplants at Le Bourget

ONLY a lack of Russian aero-engines prevented visitors to Le Bourget from seeing a representative selection of the World's leading powerplants. Nevertheless, they could compare the latest products of the West's big four—Rolls-Royce, Bristol Siddeley, General Electric and Pratt & Whitney—as well as those of many other famous companies. A detailed survey of the British engines on view was given in our issue for June 12.

So far as big subsonic powerplants are concerned, this has been the year of the turbofan, ducted-fan and by-pass engines. All are similar in their aim of exhausting a larger mass of air more slowly than the conventional jet engine and thus giving a higher thrust at a lower specific fuel consumption. Rolls-Royce started the current trend with their Conway, now flying in the Handley Page Victor 2 bomber and the B.O.A.C. version of the Boeing 707 transport; they are now developing a second-generation engine of this type, the RB 141, which will power the D.H. 121 airliner now under development for B.E.A.

Interest in Paris centred on the U.S. answers to the Conway—the Pratt & Whitney JT3-D and the General Electric CJ-805-23 turbofan engines, which were on show in Europe for the first time. Interestingly, both were shown sectioned, while the internal arrangement of the Conway has not yet been revealed, presumably because of its use as a military engine.

Both the U.S. turbofans are derived from military engines—the Pratt & Whitney J57 and the General Electric J79 respectively. But there is no similarity when it comes to the location of the turbofan; a two-stage fan forms the first two compressor stages of the JT3-D, while the CJ-805-23 has a single-stage aft-fan driven by a free turbine stage.

The controversy on fan position is a lively one; Pratt & Whitney issue a leaflet entitled: "Why we put the fan up front," while a General Electric Press release gives their reasons for putting theirs at the rear. Neither mentions the drawbacks of their respective solutions or the increases in weight, complication and difficulty of installation that these new engines involve.

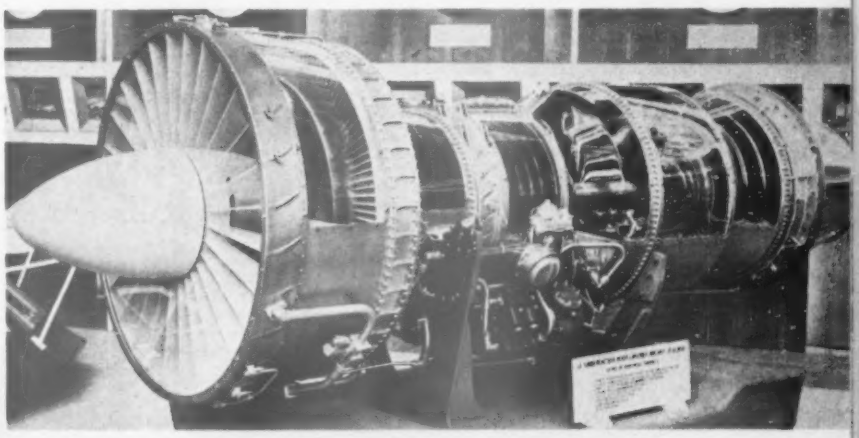
But their advantages far outweigh their drawbacks and fan engines will almost certainly become popular for high-speed subsonic airliners in the near future. The JT3-D turbofan, for example, gives a thrust of 3,500 lb. at an s.f.c. of 0.78 lb./lb./hr. when cruising at 35,000 ft.; this thrust is 17% greater and the s.f.c. 12% lower than for the comparable JT3 engine which has no fan.

A new British engine announced at Paris is the Bristol Siddeley BE 53, which is termed a "lift thrust" engine. Its thrust-to-weight ratio is claimed to be higher than that of any existing turbojet. It can provide both direct lift and thrust for forward flight, making possible the design of high-speed aircraft with both VTOL and STOL characteristics.

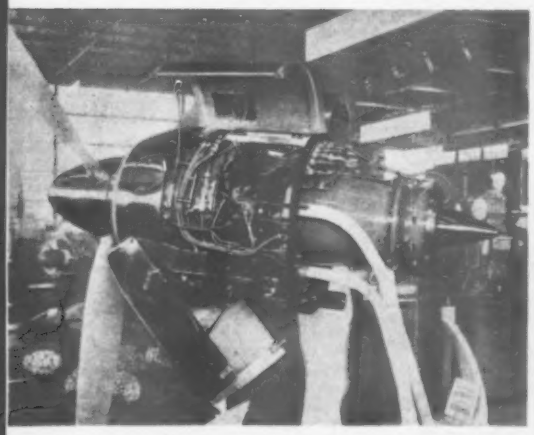
The BE 53 is a ducted-fan engine with a high by-pass ratio; its exhaust is discharged through outlets to give either lift, forward thrust or combinations of both; it can also give braking thrust when the aircraft is landing. This engine has been mentioned as the powerplant for the P.1127 lightweight VTOL fighter and strike aircraft under development by Hawker Aircraft as a possible "third-generation" NATO ground-support fighter. No doubt other design teams are also considering this engine for similar projects or as a powerplant for civil transports, where its low cruising s.f.c. would be a big advantage.

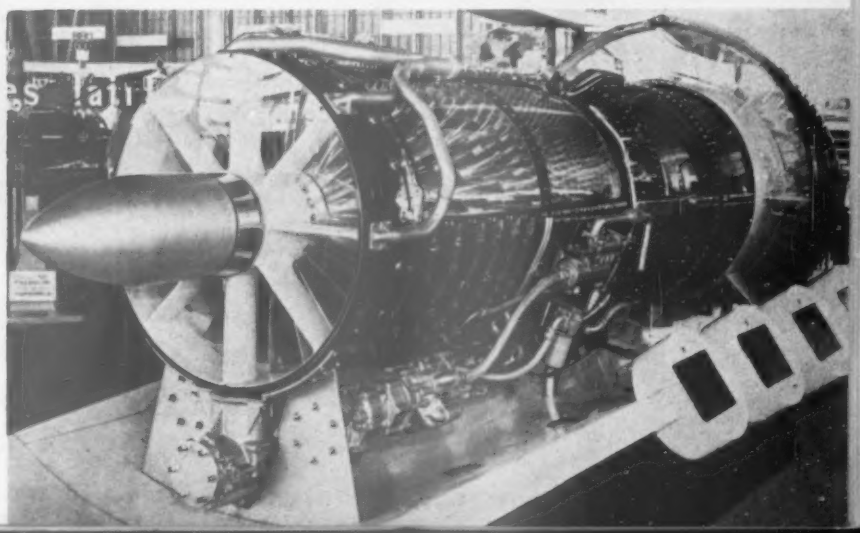
No details of BE 53 performance have yet been given, but its take-off thrust is said to be similar to that of the Olympus, which gives about 17,000 lb. s.t. "dry." The engine is based on Bristol Aero-Engines' experience with the Olympus, the Orion turboprop and the Orpheus, and may well use some of the components developed for these engines.

French achievement in a somewhat specialized propulsion field was exemplified by the demonstration of the Nord



FRONT OR REAR?: Two U.S. turbofan engines—the front-fan Pratt & Whitney JT3-D (above) and the rear-fan General Electric CJ-805-23 (below)—are examples of recent engines intended for subsonic turbojet transports.





FRENCH TURBOPROP.—Selected as the powerplant for a range of French aircraft including the Morane Saulnier Epervier, the Dassault Communauté and the Max-Holste Super Broussard, the Turboméca Bastan 2 delivers 740 h.p. for take-off.

Photographs copyright "The Aeroplane and Astronautics"

INTO THE GRIFFON.—This view of the intake of the Nord Griffon 2 turbo-ramjet research aircraft shows clearly how an Atar turbojet engine is mounted in the centre of its ducted fuselage, which acts as a ramjet.

Griffon 2 turbo-ramjet aircraft. This has a SNECMA Atar turbojet mounted in the centre of the large duct which forms its fuselage and also acts as a ramjet. At high speeds the ramjet component of the propulsion system provides most of the aircraft's thrust. More advanced aircraft using this technique are under study by Nord and SNECMA are developing versions of the Atar for operation up to Mach 3.

This type of powerplant demands complete integration of the engine and airframe, and the Griffon 2 is probably the most "integrated" aircraft yet to appear. In Britain, Bristol Siddeley Engines—who have developed the Thor ramjet—are enthusiastic advocates of turbo-ramjet propulsion for the Mach 3 supersonic transport.

In the really high-thrust bracket, it was interesting at Le Bourget to study the General Electric J79 and the Pratt & Whitney J75, the two engines which power the most potent U.S. military aircraft. The J79 is installed in such aircraft as the Lockheed F-104 and the Convair B-58; it is claimed to have more than 90% of all U.S. Mach 2 flying time to its credit. The J75 powers the Republic F-105 and the Convair F-106. Civil versions of both engines are produced for current U.S. jet transports.

There was no visual evidence of General Electric's work on its J93 engine for the Mach-3 North American B-70 bomber and F-108 fighter. But its development was said to be on schedule—as was work on the company's nuclear aircraft powerplant.

A study of the engines displayed showed clearly how physically small the modern low-thrust turbojet can be. Typical power units of this type were the Pratt & Whitney JT-12, the General Electric J85 and the Rolls-Royce RB 108. With take-off thrusts varying between 2,000 and 3,000 lb., these engines have weights ranging from 250 to 430 lb.

The development potential of small turbojets has been clearly indicated by the impressive stretch in performance of the Bristol Siddeley Orpheus. This began life as a relatively low-thrust engine and now, in its latest B.Or.12 version, produces a thrust, with simplified reheat, of 8,650 lb.: its dry weight is only 1,100 lb.

Examination of the turboprop and turboshaft engines at Le Bourget leaves two main impressions—the continuing pre-eminence of Rolls-Royce where the larger engines are concerned, and the bewildering multiplicity of the engines in the 1,000-h.p. class—not all of which, surely, can survive in the hard world of today.

The Rolls-Royce Tyne is obviously set fair to becoming as much a classic engine as its forerunner the Dart. Its applications are widening fast—the Vickers Vanguard, the Canadair CL-44, the Short Britannic and now the NATO maritime reconnaissance aircraft and the two-Tyne military transport to be developed jointly by Nord Aviation and three German companies.

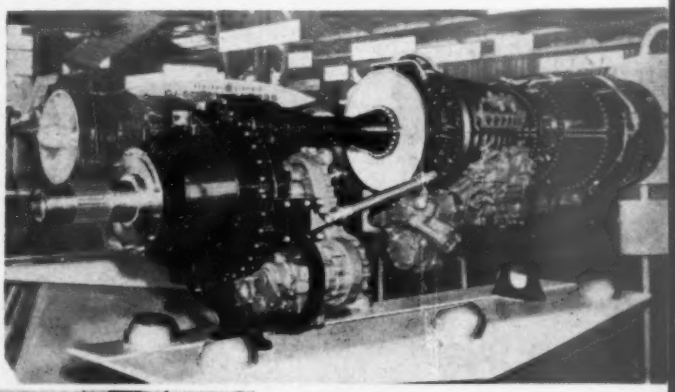
No turboprop engine yet rivals the Dart in operating hours—these are said to rise at the astonishing rate of one every 9.6 sec. and are now approaching a total of 8 million hr. Component endurance of parts of the Dart engine were indicated by an exhibit which included flame tubes which had been in airline service for 4,000 hr. and a high-pressure turbine disc and blades which had run for 8,200 hr.

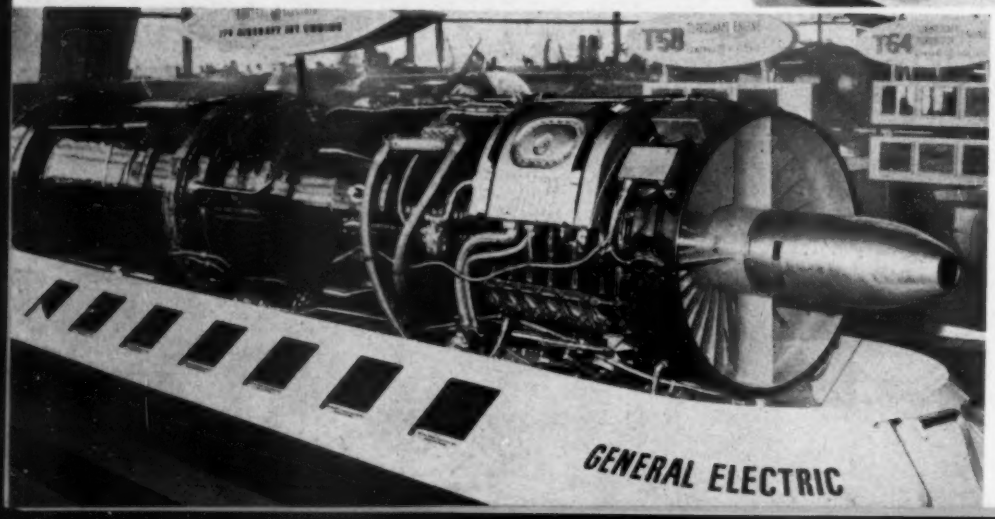
An interesting new turboprop (or turboshaft) engine on show for the first time was the General Electric T64. This is claimed to produce 2,570 h.p. at an s.f.c. comparable with that of piston engines.

Small turboprop and turboshaft engines to be seen included the Bristol Siddeley P.181, the de Havilland P.1000, the Turboméca Bastan, the Lycoming T53, the Blackburn A.129 and the General Electric T58—produced as the Gnome in England by de Havilland. In wideness of applications the T58 is ahead of its rivals. These engines make a fascinating study; although their power outputs are similar, their configurations vary widely.

No particularly novel exhibits were to be seen in the rocket-propulsion field, although the Reaction Motors XLR-99 rocket for the X-15 was on view and Rocketdyne showed an early model of its 150,000-lb.-thrust motor for the Thor IRBM. An exhibit by the French company SEPR showed its SEPR 841 rocket pack for the Mirage 3 fighter and trainer. And Napiers exhibited their Triple Scorpion.

All in all, for those visitors whose particular interests lay in the powerplant field, this year's Salon provided much that was worthy of close study and a useful ration of new things to look at. Indeed, once again this particular section of the static exhibition represented a major share of the interest.—J.R.C.





NEW G.E. TURBOSHAFT.—(above) The General Electric T64 is a new 2,570-h.p. engine which can be used either as a turboprop or as a turboshaft engine for helicopters.

MASSIVE J79.—(left) Claimed to have over 90% of all U.S. Mach-2 flying time to its credit, the General Electric J79 powers many of the latest American military aircraft.

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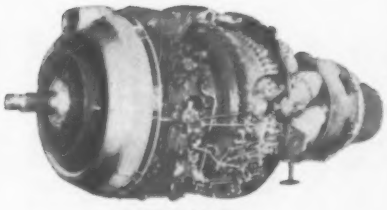
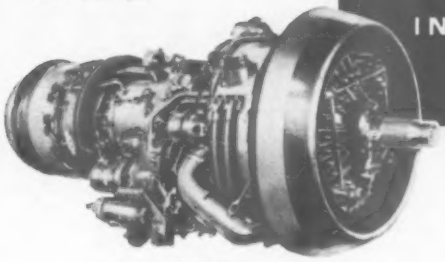
ROLLS-ROYCE POWER

IN THE SERVICE OF AVIATION



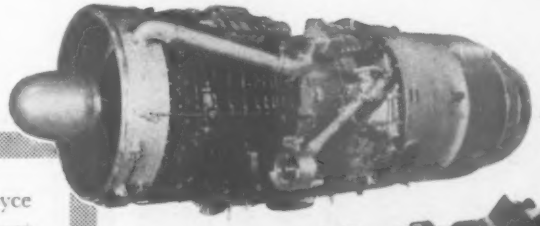
DART PROP-JET



TYNE PROP-JET

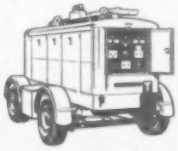
The Rolls-Royce Aero Engine Division is the largest organisation in Europe producing aero engines for Civil and Military use. Over 34,000 people are employed in the design, development and manufacture of turbo jets and prop-jets which are in service with, or on order for, 21 armed forces, over 60 airlines and more than 20 other operators throughout the world. Rolls-Royce are developing the rocket motor for Britain's long range ballistic missile.

AVON TURBO JET (MILITARY)



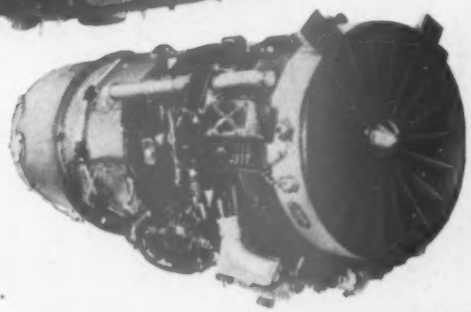
AVON (CIVIL)

Aviation is also served by Rolls-Royce Diesel and Petrol engines which power airfield and ground equipment.

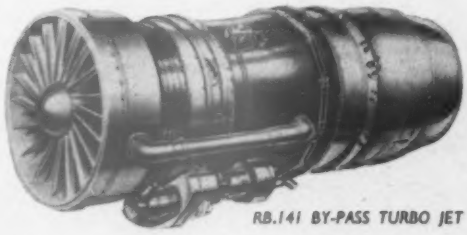


Petbow Ground Starter Unit powered by a Rolls-Royce Diesel Engine.

Airfield Crash Tender on a Thornycroft Chassis powered by a Rolls-Royce Petrol Engine.



CONWAY BY-PASS TURBO JET



RB.141 BY-PASS TURBO JET

ROLLS-ROYCE LIMITED, DERBY, ENGLAND

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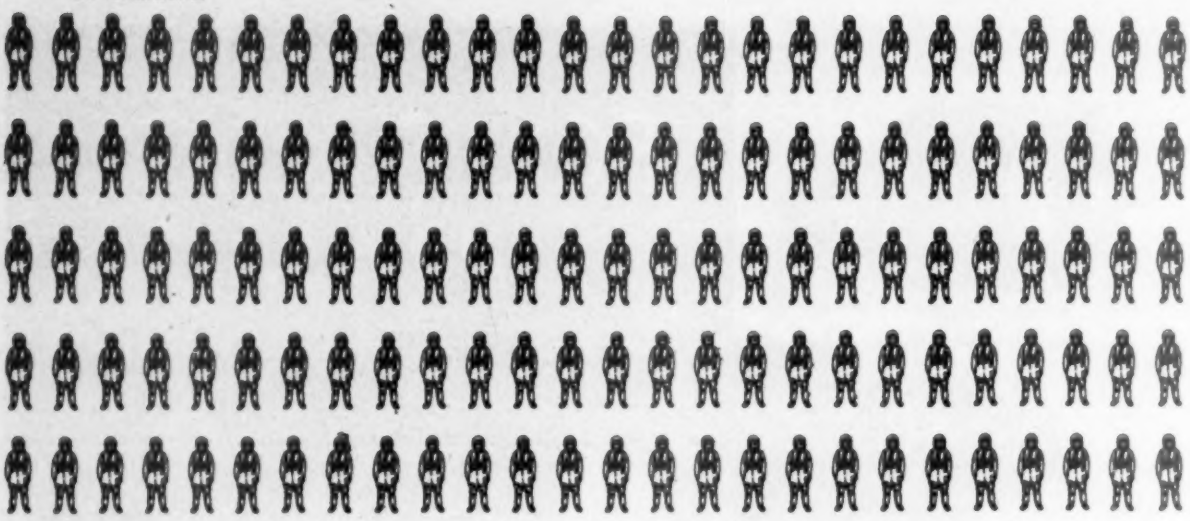
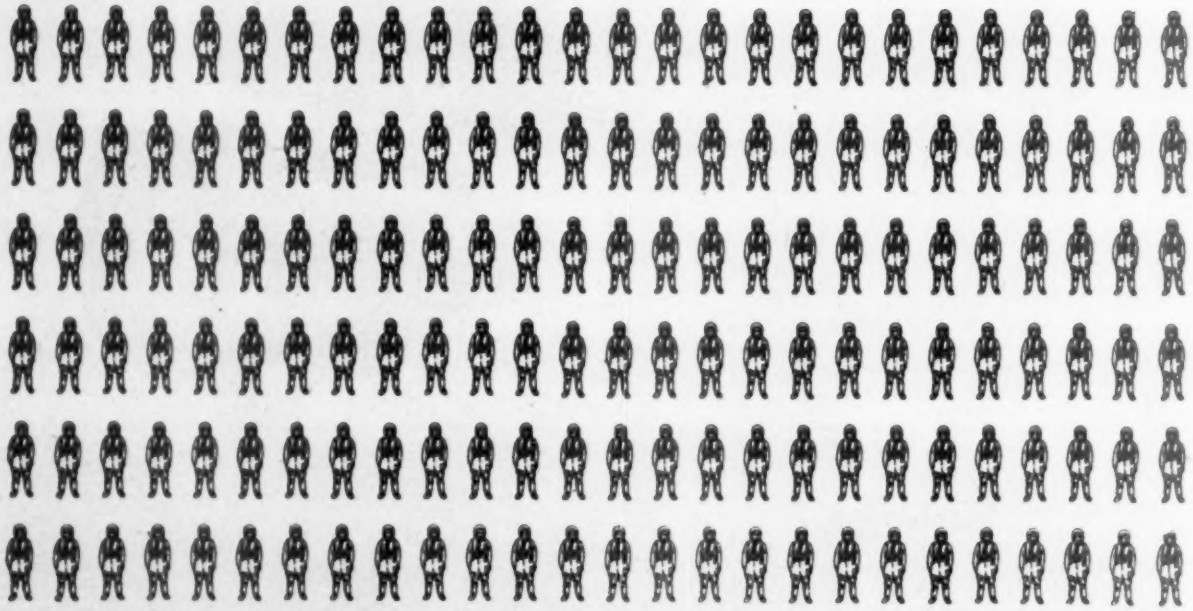


To date 286 lives have been saved by Martin-Baker Ejection Seats.



MARTIN-BAKER AIRCRAFT COMPANY LIMITED

Paris Show Report . . . .

Missiles and Space Exhibits

TOWERING high over the missile park at Le Bourget were the shells of an early Convair Atlas ICBM and a Thor-based Moon-probe vehicle; close beside was a U.S. Army Redstone surface-to-surface missile, backed up by a Nike Ajax and a Nike Hercules surface-to-air missile. Other U.S. exhibits here included the shell of a Discoverer satellite, a U.S.A.F. Mace on its launcher and a U.S. Army Honest John surface-to-surface missile. In the background was a Bomarc surface-to-air missile.

With this line-up, the overall missile honours could not fail to go to the United States, but it was the U.S. Army, oddly enough, which gave a more convincing demonstration than the U.S.A.F. The Army exhibits were operational missiles based in Europe and attended by their launching crews, while the U.S.A.F. missiles—apart from the Mace—came from a U.S.A.F. "exhibition circus" and were in fact the self-same hardware which was displayed at the recent World Congress of Flight in Las Vegas. They were interesting mainly as showing the size and shape of the operational missiles they represented, but did little more.

The side-show atmosphere was accentuated by the presentation of the Atlas ICBM, which was merely the motorless shell of an early Atlas, stripped of its interior and strengthened so that it could be raised by an "exhibition-type" erector. The bizarre effect was heightened by two doors cut into its sides so that visitors could enter the missile and gaze at display panels of colour transparencies installed inside.

British missiles exhibited in this external park were the Bristol/Ferranti Bloodhound, attended by an R.A.F. crew, an English Electric Thunderbird with an Army handling team and an Armstrong Whitworth Seaslug mounted in a two-barrel rail launcher—the Seaslug is the only British missile which is rail-launched.

One of the most interesting missiles on view for the first time was the Short Seacat, which was exhibited in its operational form. Designed to replace the Bofors gun as a naval short-range anti-aircraft weapon, the Seacat is a subsonic missile with cruciform moving wings and cruciform fixed fins.

It was shown without a booster, suggesting that it has a two-stage solid-propellent motor combining the boost and sustainer functions. Flare holders on the tail fins are a feature of the operational missile, which may well be controlled by visual tracking and a radio command-guidance system. The missile appears to be relatively light, simple and cheap; its "ground-handling equipment" could be simply two men. A land-based version, the Tigercat, is being developed by Shorts as a private venture.

French missiles on show were the Matra R.422 B2, a tandem-boosted surface-to-air missile with a maximum speed of Mach 2.5 and a range approaching 40 miles; the Sud SE 4400 experimental surface-to-air weapon, a tandem-boosted missile with a ramjet sustainer which has a speed of Mach 3.6 and reaches an altitude of more than 160,000 ft.; the Sud SE 4200, a subsonic ramjet-propelled artillery missile which is command-guided over a range of 15 to 55 miles; a Veronique sounding rocket, one of which went up nearly 110 miles in March this year; a four-stage solid-propellent ONERA research vehicle designed to achieve Mach 7 and reach an altitude approaching 200 miles; and Nord SS10 and SS11 wire-guided surface-to-surface missiles mounted on a variety of army vehicles. On the Nord stand a further development of this missile, to be known as the SS12, was exhibited as a model.

An interesting new French air-to-air missile was the Matra R.511, which is due to enter service on the Vautour-2N fighter early next year; it may also be carried by the Mirage 3. Its service trials are now in progress. This large missile weighs nearly 400 lb. and is propelled by a two-stage solid-propellent motor. It uses semi-active homing, has a speed at motor burn-out of Mach 1.8 and a range of 5 miles.

A feature of the display was the wide variety of missile target drones on view; these ranged from the supersonic ramjet-propelled Nord C.T.41 and the turbojet Radioplane Q-4 to small piston-engined drones such as the Radioplane OQ-19, which has been produced in thousands for the U.S. Services. The production of supersonic drones for the effective testing of surface-to-air missiles has obviously received much attention.

Small wire-guided anti-tank missiles abounded at the Salon. The Nord SS10 and SS11, already mentioned, are well-known examples of this type. A new one, and the smallest on view, was the Bofors Bantam. This tiny missile weighs just over 13 lb., yet carries its hollow-charge warhead over a maximum range of 1¼ miles. Complete with its launching container, it weighs only 20 lb.

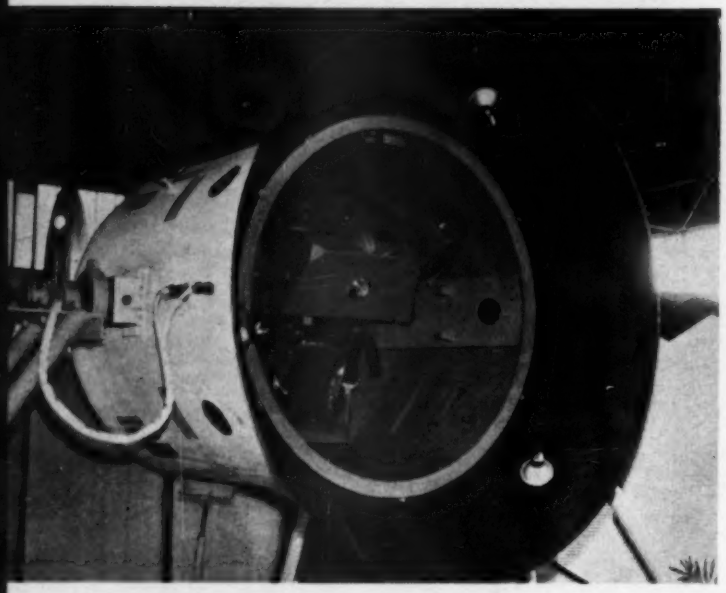
Astronautical Display

Little was to be seen of space projects at Le Bourget apart from the large "aero-space" exhibit of the U.S.A.F. Only Chance-Vought showed a space vehicle—a large model of their four-stage Scout satellite-launcher reared above the company's stand. (Cutaway drawing THE AEROPLANE AND ASTRONAUTICS, June 19.)

The U.S.A.F. exhibit surveyed a wide field of research and

MISSILE SKYLINE.—Behind the Bristol Bloodhound, a Redstone SSM, a Thor-based Moon-probe vehicle and an early Atlas ICBM dominate the missile skyline at Le Bourget. Dwarfed by the Atlas is an SE 4400 experimental ramjet missile.

Photograph copyright "The Aeroplane and Astronautics"



MAN IN SPACE.—This General Electric mock-up of a manned space capsule was exhibited by the U.S.A.F.

Paris Show Report . . . .

development covering high-speed aircraft as well as space projects. Also included were a range of missile models and items of missile hardware, including a Minneapolis Honeywell three-axis gyro reference pack for Titan ICBM guidance and a liquid oxygen cut-off valve from the Atlas ICBM. Suspended from the roof of the exhibition hangar was a full-scale mock-up of the North American X-15.

Inevitably, the greatest interest attached to space research. U.S. work on its medical aspects was shown by an early sounding rocket into which two rather sad-looking model monkeys were strapped, and in the small gondola of the "Man High" project in which a U.S.A.F. doctor spent 32 hours suspended beneath a balloon and rose above 100,000 ft.

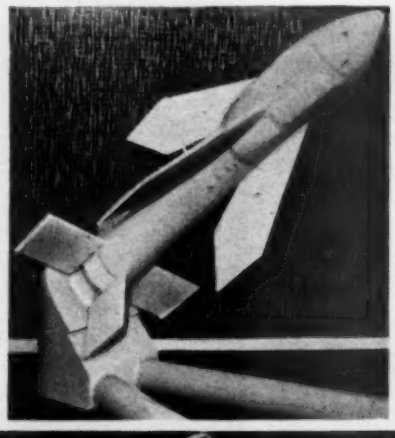
A fascinating exhibit was a cage with live black mice used for space research; each of these mice had a minute telemetry set attached to its back to transmit information on the action of breathing muscles and body movements. The mice were able to move around quite freely with this equipment attached to them.

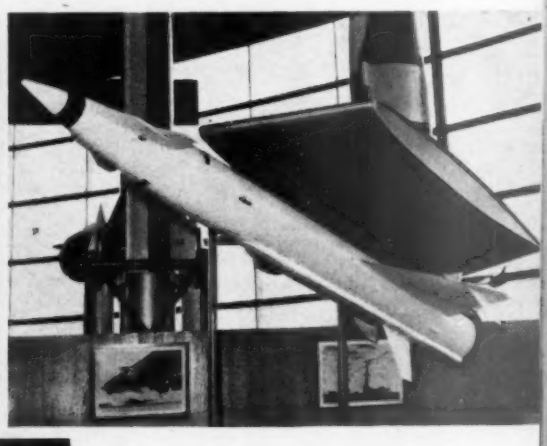
A General Electric mock-up of a manned space capsule was also shown. This incorporated a pivoting rest for the astronaut, shaped as though cast to the form of his body, so that acceleration and deceleration loads would be evenly distributed.

Research on food for space travellers was indicated by metal-foil tubes from which food could be squeezed for consumption in zero-*g* conditions. This exhibit would suggest that U.S. astronauts will live on reasonably conventional foods rather than special ones; tubes on view included "pork dinner," chicken noodle soup, apple sauce, peaches and fruit dessert.

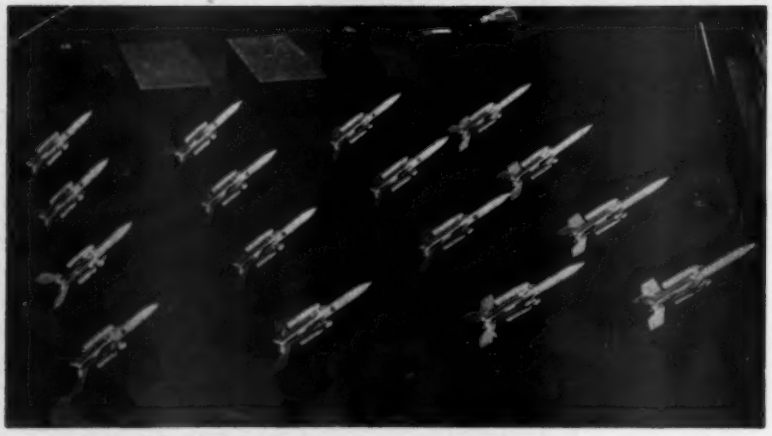
Techniques for providing auxiliary power and propulsion in space were shown by demonstrations of a solar battery and ionic propulsion. The small solar battery was placed under a hot lamp and provided sufficient electric power to drive a small motor. The ion propulsion exhibit was reminiscent of those in the Science Museum at South Kensington; one pressed a button, and an S-shaped wire pivoted above a large insulator emitted a constant blue forked-lightning discharge from each of its ends and began to revolve slowly.

These exhibits emphasized the dominating position of the U.S. in both space and missile developments; it was unfortunate that Russian participation at Le Bourget was limited to its Tu-104, Tu-114 and Il-18 transports and gave no indication of Russian work in the space field.—J.R.C.





SEACAT REVEALED.— (right) Simplicity and cheapness have been emphasized in the design of the Short Seacat SAM, which is to become the standard short-range anti-aircraft missile of the Royal Navy.



MATRA MISSILE.—(above) The new Matra R.511 is a large semi-active homing AAM which will equip the fighter version of the Sud Vautour.

BLOODHOUND BATTERY—This new model of a Bloodhound SAM site (left), has two target-illuminating radars and sixteen missile launchers—suggesting that missiles will be fired in salvoes rather than singly.

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ASTRONAUTICS and MISSILES

Convair's High-pressure Tank System

"Balloon" Tanks for Atlas

WHEN the V-2 rocket was designed at Peenemünde in 1940, the only reliable method of containing its fuel and oxidizer was to produce separate tanks of aluminium and mount these in an all-embracing structure comprising frames, stringers and sheet steel. This method of construction has long been superseded, and the pressurized tank system first developed by Convair in 1946 is now a feature of all liquid-propellent ballistic missiles of note; in the Convair Atlas, for example, a single very light tank feeds all three main engines.

Integral Tanks

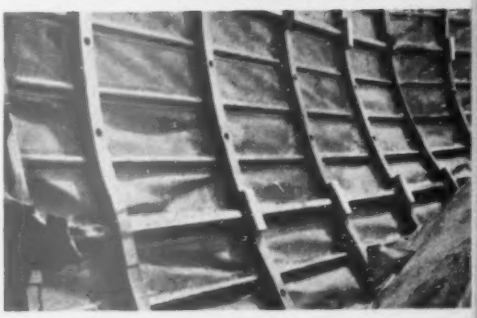
The idea of a pressurized integral tank for missiles was first conceived by Mr. K. J. Bossart, technical director of Convair-Astronautics, shortly after the end of the War when he and other Convair engineers were designing the MX-774 research missile. Convair had used integral wing tanks in flying-boats more than 20 years before and, recalling this, Bossart set about the design of a missile in which the external skin served the double purpose of primary structure and tank wall.

This, however, was only half the story. The main advance came with the further suggestion that a high internal tank pressure could be used to stabilize a thin-wall container, thereby eliminating the need for supporting frames and stiffeners.

The new method of tank construction was tested with light aircraft-type aluminium tanks in three MX-774 test vehicles launched in 1948. And when the Atlas project finally got under way in 1951 thin-gauge pressurized construction was the order of the day.

Atlas is an excellent example of the new structural technique. Its tank bay, measuring 60 ft. by 10 ft. diameter, has no internal framework and, in fact, comprises the total structure from the propulsion bay to the nose-cone.

How a structure of this kind, containing more than 90 tons of propellents, stands up to inertial forces produced by a take-off thrust of 390,000 lb. is, perhaps, difficult to imagine by conventional standards. The secret is that the tank bay is kept under constant pressure to maintain its shape by feeding helium gas into the ullage spaces at the top of the tanks.

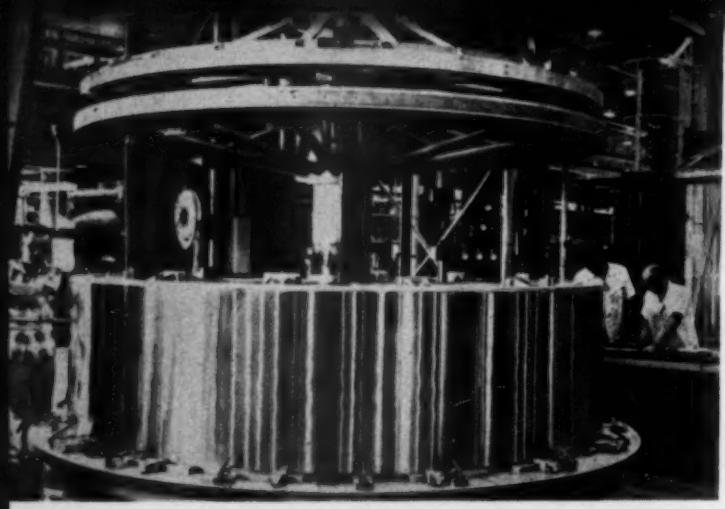


The old-style method of containing propellent is typified by the German V-2 rocket, which had separate tanks for oxidant and fuel (right) supported by an external structure of frames, stringers and skinning (right, below).

The pressure, therefore, has the double rôle of helping to force propellents to the engines and of keeping the Atlas skin drum-tight throughout the period of severe loading conditions imposed during launching and sustained flight. In the same way, an elongated toy balloon, blown up hard, is quite rigid and will withstand considerable longitudinal compression before bursting.

This lightweight pressurized steel Atlas structure looks remarkably flimsy but, in fact, its thinnest wall meets a specification for minimum tensile strength of 200,000 lb./sq. in. The complete tank is fabricated from a special cold-rolled austenitic steel (AISI grade 301), produced by the Washington Steel Corporation of Washington, Pa., which is delivered to Convair

"BALLOON" TANKS.—1. Manufacturing high-pressure, stainless-steel, integral tanks for the Atlas ICBM at the factory of Convair-Astronautics, San Diego, California. Stainless steel not much thicker than heavy metal foil is unrolled for fabrication into a section of a tank.



2. Construction starts with the butt-welding of a strip of stainless steel sheet 3 ft. wide and more than 30 ft. long, stretched on a circular former.

in coils consisting of long, flexible bands approximately 3 ft. wide. The material is noted for its toughness, strength-to-weight ratio, ease of handling and resistance to heat, cold and corrosion; also, it is easily formed and welded.

The prototype tank was constructed under sub-contract by Solar Aircraft Co. in San Diego, starting in the winter of 1953, its strength and rigidity being tested with satisfactory results at Convair's Point Loma test site the following October. From that time all Atlas tanks have been manufactured in the Convair factory.

Convair worked with the welding industry to develop new welding techniques and fabrication equipment, and a basically simple method of construction was quickly evolved. The process begins with the butt-welding of the 3-ft. bands of stainless steel, the joint being reinforced with an underlying strip of stainless steel. This circular band forms the first section of an Atlas tank.

A number of circular bands lap-welded together form the cylindrical section of the tank shell. During this stage of the assembly the tank is supported by ring-shaped formers to maintain its shape.

At the forward end the tank tapers and is capped with a stainless-steel bulkhead. A similar, larger, bulkhead is located near the centre of the tank to separate the two propellent storage spaces, and a third bulkhead of conical shape seals the aft section.

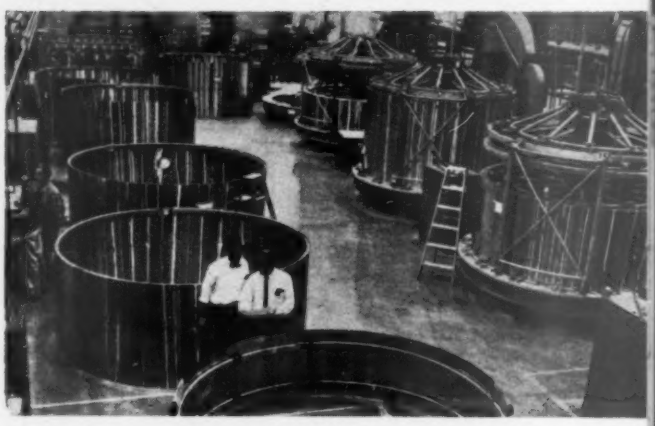
Installation of this aft bulkhead represents the final stage of tank assembly. A special two-armed welding device is used in this operation, one of the arms working on the outside of the seam, the other on the inside. This is accomplished by inserting the internal arm through a 24-in. access hole at the apex of the aft bulkhead.

Final welding process lasts about 16 hours, during which period two men, a welder and a mechanic, must remain inside the tank. The mechanic's job is to relay progress of the internal welding operation to outside operators by intercom. The "internal" crew is changed every two hours, the men leaving and entering the tank through the 24-in. hole. When the work is done the welding arm is removed, the two men emerge, and a conical section is fitted over the access hole to seal the tank.

The tanks can now be gas-pressurized and the wrinkles in the skin disappear. The supporting rings can then be removed and the tank, which embodies special reinforced attachments at each end, can be hooked on to an overhead crane and lifted bodily from the factory floor. As an accompanying illustration shows, the internal pressure prevents any mid-section sag while the tank is being moved. In fact, when internally pressurized the tank can be struck heavy blows with a hammer without permanently indenting the walls.

High pressures are not required during handling, transportation and preparation on the flight pad; for these purposes, pressures of less than 10 p.s.i. are required. If at any time the structure is placed under longitudinal stress (i.e., stretched) the tank can be depressurized and entered by inspection and repair crews.

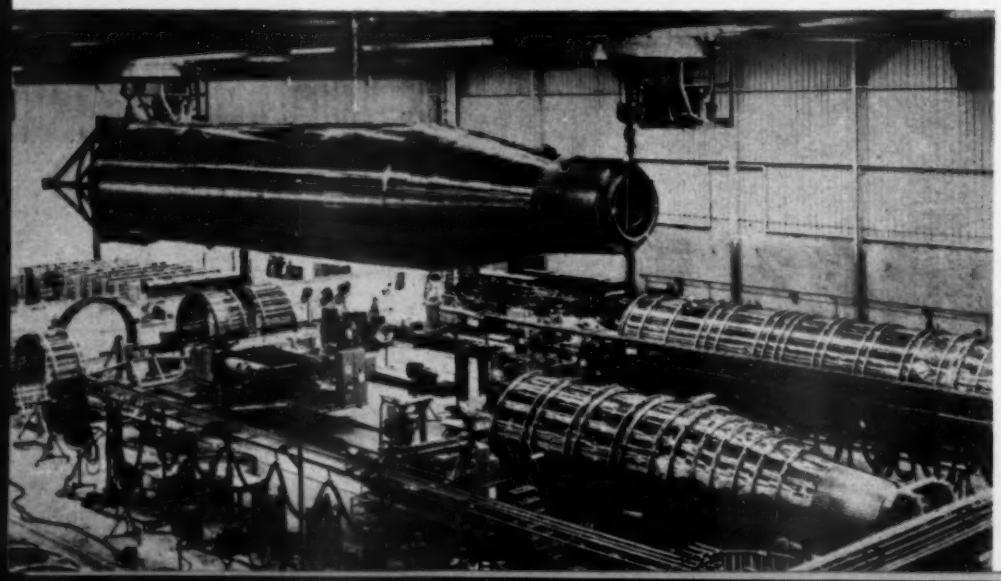
Skin gauges vary throughout the structure, according to different areas of stress concentration. Several of the 27 sections that go to make the complete tank shell are not much thicker than heavy-gauge metal foil, the heaviest gauge being less than 0.04 in.



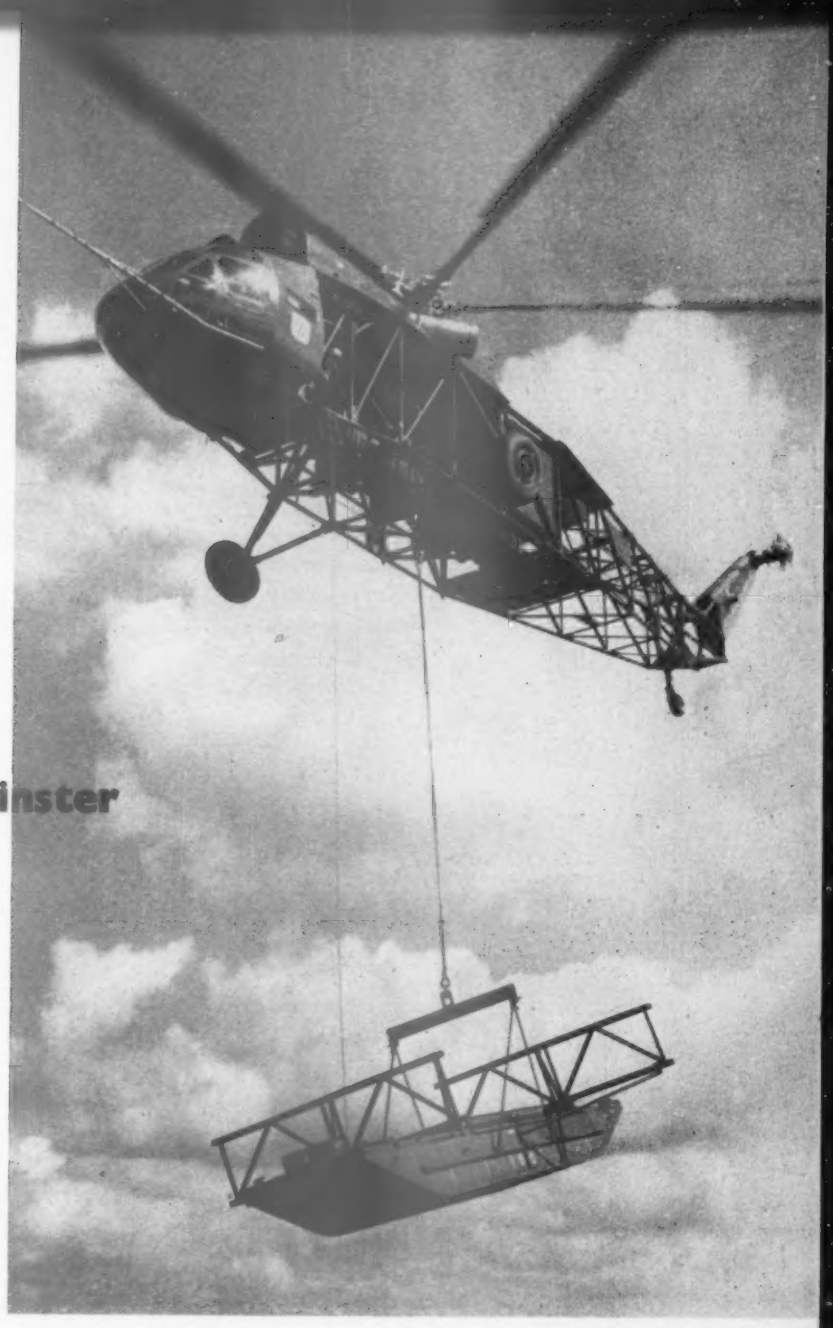
3. Single sections (foreground) are welded together in pairs, (left rear); right, fixtures for joining the circular bands together.

One advantage of this structural technique is that the airframe can be readily converted to other missions without any change in the basic design or welding equipment. Thus, Atlas boosters are being built for the Vega, Centaur, Discoverer and Mercury space programmes by merely increasing the skin gauge in certain areas, or substituting additional 10-ft. bands to replace the forward tapered section.

The structure's integrity was demonstrated in a dramatic way during the launching of the Atlas prototype in June, 1957, when propulsion was lost in one engine at an altitude of only a few thousand feet. Before its destruction by the range safety officer, the missile—which still contained more than half its propellents—went through a series of violent gyrations, including a loop, yet remained completely intact.—K.W.G.



4. Made up into the complete tank measuring 60 ft. × 10 ft. diameter, with no internal framework apart from a bulkhead to separate the liquid oxygen and RP-1 fuel, the whole structure is pressurized to maintain its shape, and skin wrinkles disappear.



Air mobility with the Westminster

The Westminster is the largest conventional helicopter in the Western world.

It has the ability to transport as many as 51 fully-equipped troops and to convey mobile field units such as hospitals, food kitchens, living huts, vehicle servicing centres and operations rooms from supply bases to assault areas. It may also be used to recover unserviceable aircraft and ground vehicles and to transport complete missiles from storage units to firing sites.

All these capabilities meet the requirements of modern army, naval and air operations.

The Westminster is powered by two Napier "Eland" gas turbine engines and can operate with full payload on one of them if need be.

The picture shows a section of an assault floating bridge weighing 6,736 lb. being transported.

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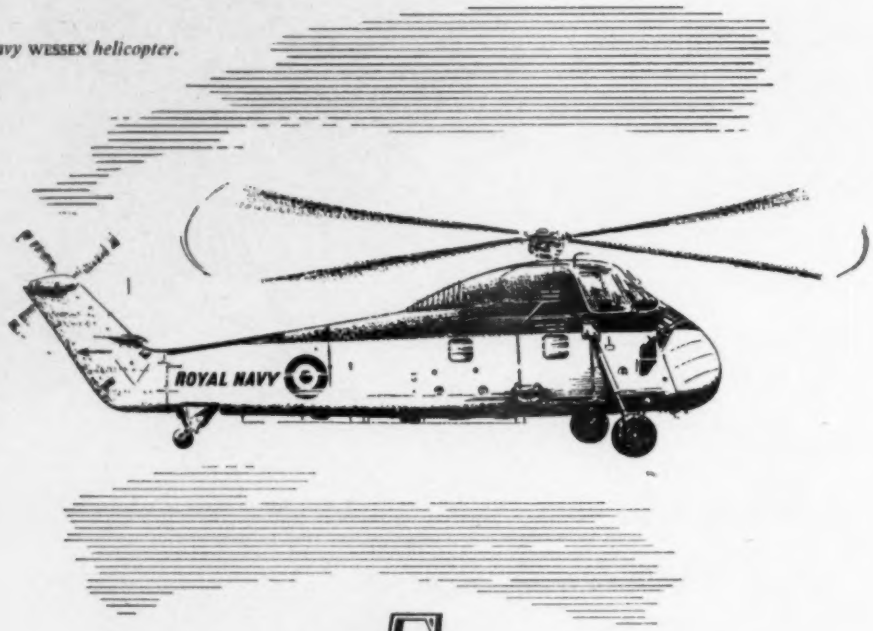
A Royal Navy WESSEX *helicopter.*



NEW 5 YEAR

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AAA7

Correspondence

Space Research Programme

IN your issue of June 5 you say, "That the Steering Group on Space Research contains the name of Dr. R. Van der R. Wooley is, to say the least, cause for wonder."

In the light of our "fixed" and somewhat presumptuous environmental conception of Space we all, on the instant, probably agree with you; but on reflection the inclusion of a man who is not apparently "maddened by the dangling carrot" is surely not such an unenlightened gesture. By "presumptuous environmental conception" I mean that perhaps it would not be unrealistic to suggest that in planning an invasion of Dry Land, King Neptune would be likely to prepare all his plans and equipment in terms of Wetness—a typical logical negation arising from an environmental "fixation."

We live and think in terms of environment of different and scattered light (which we have mastered by the evolving of a suitable system of eye rods and cones). And so, sir, just as the invading Neptunites would die of dry-rot, might not we also, in Space, pass out with light-rot?

Vegetation, upon which we are parasitic for our mastery of light, has a different conception than we have of illumination dynamics, using basaltic magnesium in a manner we need not bother with here—but in Space?

The inclusion of Dr. Wooley, sir, could indeed give us cause to wonder—in time perhaps.

St. Albans, Herts. L. C. WRIGHT.

The Helicopter Comes to Town

IT is interesting to note that after many weeks of heart searching and serious deliberation the Ministry of Transport and Civil Aviation has relented and is to allow experimental helicopter sightseeing flights over Central London for six times per day on six Saturdays only.

At a time when capital cities throughout the World are benefiting from regular city-centre scheduled helicopter services the surprising initiative and foresight shown by the Ministry of Transport and Civil Aviation after weeks of consultation are to be admired. The citizens of Brussels, Paris, Rotterdam, New York, Chicago, etc., cities which have enjoyed city centre helicopter operation for years, can only commend the initiative, daring and foresight shown by Mr. Watkinson and his staff at Berkeley Square House.

By restricting the proposed services to Saturdays when presumably the alleged noise nuisance will be minimized, the Ministry of Transport have shown themselves to be in the forefront of progress and, indeed, appear to be tackling the helicopter question with the same sense of urgency with which in the past the Ministry has tackled the national road programme.

Mr. Harold Watkinson, M.P., had better be careful lest he should mar his political career by creating the impression that his Ministry is applying itself too readily to new ideas and techniques. For the "Stage Coach" stalwarts of the Ministry to give consent for at least six days of helicopter operations over Central London is a step for which all helicopter enthusiasts must be truly thankful.

London, W.1. HENRY M. BERNEY.

Small v. Large Helicopter

WE read with interest the report on B.E.A.'s activities in the agricultural field (THE AEROPLANE AND ASTRONAUTICS, June 12, page 663).

Whilst it is encouraging for the industry to see the use of a large helicopter for this work we do feel that the report calls for the following comments.

On the point of size of helicopters which have been used for agricultural work in this country one remembers the Cierva Air Horse some years ago, which was sanctioned by the Ministry of Supply with the support of the Agricultural Research Council. That machine met with an untimely end and was a tremendous setback to such development. This machine had an all-up weight of 17,500 lb. compared with 6,800 lb. for the S.55.

Also in 1951, a Westland S.51 was widely used for spraying by a well-known company and this machine had, in fact, a forward sprayboom which was later discarded in favour of a rearward placed one.

The economics of operating a large helicopter such as the S.55 compared with a smaller machine for agricultural work are probably well known to B.E.A. The manufacturers of the Kolibrie, for instance, claim a figure of £17 an hour for operational costs to include pilots' and engineers' salaries and overheads. B.E.A., no doubt, will be agreeably surprised when they commence operations with the Bell 47 which is a machine, in our view, of much more suitable size for this country.

We trust that this enthusiasm will not lead to the use of the Rotodyne for crop spraying as was mentioned in a popular aircraft weekly in April this year! However, it may well be that the larger helicopter will come into its own for the application of fertilizers, where a large payload will assist operations requiring application rates of 5 cwt. per acre.

Hampton, Middx. S. W. G. FOSTER, A.F.R.Ae.S.

Groundabout

Changing Face. After rockets and STOL and VTOL there's now the Saunders-Roe Hovercraft to find a new set of terms for. I suppose it's an aircraft since it gets airborne and carries an air pilot but surely it didn't fly over the Solent so much as above it? And I did like the announcement that it made its first flight "at the Cowes factory."

*

The Quiet One. A Northeast Airlines Viscount was delayed recently for 12 minutes after the pilot had reported a "thumping sound" in the air. Explanation given in the "Corrective action and comment" column of the delay report: "Pilot heard 17-gun salute fired for V.I.P. arriving at airport."

*

Through the Dirt Barrier. Not long ago, this column noted that a friend's kitchen water-heater had built-in reheat. Now comes an advertising announcement of a Home Laundry with Turbo-Jet Washing Action. No price is quoted, not even a surcharge.

*

Lyneham Press On. When a Transport Command Hastings taxied in at Lyneham with a load of Pressmen and switched off, a mass of ground crew set to and *pushed the aircraft to the passenger steps!* Pending an analysis of this operation by the resident work study teams, it seems to be a good idea not to do it right under the noses of the Press. They'll make a story out of *any* damn thing.

*

Casting Off. Coastal Command have their own way of seeing off their C.-in-C.s. I remember watching Sir Alick Stevens, wearing a three-peaked cap to symbolize his three jobs, being practically shot from a gun at his farewell party at Northwood. Now Air Marshal Sir Brian Reynolds, who retired at the end of last June, has had the treatment. This is how he made his last operational trip.

by Gyrfalcon

NOTES AND EVENTS

PIPER AGENTS. — Following the lifting of import restrictions into England on all Piper aircraft, Irish Air Charter, Ltd., has appointed Vigors Aviation, Ltd., at Oxford Airport, Kidlington, to be its sole representatives in the U.K. Inquiries regarding Piper aircraft and NARCO, ARC and DARE radio should in future be addressed to Vigors Aviation, Ltd., at Kidlington.

AIRFIELD SOLD.—Mr. F. R. Evans, managing director of the engineering construction firm of F. R. Evans (Leeds), Ltd., Waterloo Mills, Pudsey, Yorkshire, has bought the major portion of the former R.A.F. airfield at Dumfries for more than £50,000. It is to be developed as an industrial estate and sites leased to manufacturers. The property includes 208 acres of agricultural land, the main runways, the three-storey control tower and five hangars.

STORNOWAY HOUSE.—The new headquarters of the Firth Cleveland Group is now at Stornoway House, St. James', London, S.W.1. Officially opened on July 14 the new headquarters contains a permanent display of the products of all the companies of the Group. The telephone number is Whitehall 2166.

PRICE REDUCTIONS.—The Metals Division of Imperial Chemical Industries, Ltd., has announced reductions in the price of wrought titanium products. The heaviest cuts are in the prices for sheet, strip, plate and wire, which are reduced by 25%. Rod and billet prices are cut by 15% and extrusions by 12½%. These reductions—the second in 12 months—bring the price of I.C.I. wrought titanium to less than half the level operating when the company started commercial production in 1955.

MADRAS APPROACH.—The Indian Civil Aviation Authorities are to install a Decca 424 airfield control radar at Madras Airport. Some 80 of these radars are now in use throughout the World, including one which has been in operation at Dum Dum Airport, Calcutta, for the past two years.

VANGUARD EQUIPMENT.—From Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd., comes news that T.C.A. has specified Goodyear tyres, wheels, and brakes and electro-mechanical anti-skid equipment for its Vanguards.

CAMBRIDGE INSTRUMENTS. — The headquarters of the Cambridge Instrument Co., Ltd., at 13 Grosvenor Place, London, has recently been extended. The company's publicity and accounts departments are now at the enlarged headquarters and its offices at 60 Buckingham Road have now been vacated.

PRODUCTION MOVE.—Production of toilet servicing units, including blanking caps, connectors and other spares, hitherto done by Air Service Training, Ltd., has been transferred to Templewood Hawksley, Ltd., of Slough. Both companies are members of the Hawker Siddeley Group.

ALUMINIUM WELDING. — The Northern Aluminium Co., Ltd., in conjunction with Aluminium Laboratories, Ltd., is doing tests and development work on a new system of consumable electrode welding for aluminium-alloy material using self-feeding guns so that a thinner wire can be used. This fine-wire welding system has been successfully used in America for about four years and one American gun, together with the attendant electrical equipment, is now being marketed in this country by Rowen-Arc (Division of Rubery Owen and Co., Ltd.), Coventry, under the name of Rowen-Gun. This can feed wires down to 0.020 in. in dia. and will weld materials as thin as 0.036 in.

ATLANTIC MEMORIAL.—The memorial to Alcock and Brown at Clifden, Co. Galway, erected by Aer Lingus, was unveiled by Mr. A. G. Alcock, brother of the Vimy's pilot, on June 15. The Vimy landed there on June 15, 1919, after the first direct flight across the Atlantic, taking 16 hr. 12 min.

ENGINE LUBRICATION. — The International Petroleum Co., Ltd., is marketing a new non-ash dispersant additive oil for piston aero-engines. Known as AeroShell Oil W and available in two viscosity grades, the oil has had over 180,000 engine hours of flight evaluation and has been granted unrestricted approval by Pratt & Whitney. It is the result of a research programme undertaken jointly by Shell laboratories in both the U.K. and United States.

MATERIALS AND DESIGN.—The first Engineering Materials and Design Exhibition and Conference to be held in this country is to take place at Earls Court, London, between February 22 and 26, 1960.

FILM AWARD.—The Shell Film Unit has been presented with a Diploma of Merit by the British Association for the Advancement of Science for its sound, colour, production "Schlieren," which was selected at the 1959 Harrogate Festival of Films as providing the best exposition of the scientific principles underlying an industrial process. Available from the Petroleum Films Bureau, 29 New Bond Street, London, W.1, "Schlieren" explains the principles of that photographic technique and shows excellent examples of its use in aerodynamic windtunnel research.

THE OIL INDUSTRY.—On August 27 will fall the 100th anniversary of the foundation of the modern international oil industry, and in recognition of this occasion the Petroleum Information Bureau has published a booklet outlining the history of the industry during the past century. Copies of this booklet are freely available on request to Petroleum Information Bureau, 29 New Bond Street, London, W.1.

COCKPIT LIGHTING.—A new, fully adjustable, supplementary lighting unit, which can be manually set to spotlight or floodlight any selected area in an aircraft cockpit, is announced by the Aircraft Components and Connector Division of Thorn Electrical Industries, Ltd., Enfield. This new cockpit utility light has a quick release universal joint mounting which, in combination with the extendable cable, enables the unit to be used as a hand torch.

Company Notices

NEW COMPANIES

Brantly Helicopters (Sales), Ltd. (629,622).—Private company. Reg. June 4. Cap. £100 in £1 shs. Subscribers (each with one sh.) are: Brantly Helicopters, Ltd., Ystrad Road, Fforestfach, Swansea; Ronald F. Daniel and Brantly Helicopters, Ltd. (jointly); Edward W. T. Barnes, 1 Upper Cheyne Row, S.W.1, and Brantly Helicopters, Ltd. (jointly). The first directors are Ronald F. Daniel and Edward W. T. Barnes. Sec.: E. W. T. Barnes, Solrs.: Stephenson Harwood and Tatham, E.C.2. Reg. office: care of Penn Elastic Co., Ltd., Ystrad Road, Swansea Trading Estate, Fforestfach, Swansea.

K.C., Ltd. (628,759).—Private co. Reg. May 25. Capt. £100 in £1 shs. Objects: To acquire, construct, prepare, provide and maintain air terminals, landing grounds and passenger and freight facilities for operators of aircraft, helicopters and aerial conveyances of all kinds, etc. Subscribers (each with one sh.): Mabel Vickers, 13 Princes Ave., London, N.10, clerk; and Lady Morris of Kenwood, Victoria House, Bloomsbury Sq., London, W.C.1, solicitor. First directors to be appointed by subscribers. Sec.: R. Lobatto. Solrs.: Barnet Janner and Co., London, W.C.1. Reg. off.: 27-33 Queens Gardens, Leinster Gardens, London, W.2.

Spain Only, Ltd. (629,256).—Private co. Reg. June 1. Cap. £1,000 in £1 shs. Objects: To carry on the business of travel agents, organizers of tours, etc. Subscribers (each with one share) are: B. C. Amiel and G. H. Gelberg, both of 111 Gloucester Place, W.1. First directors are to be appointed by the subscribers. Solrs.: Sylvester Amiel and Co., 111 Gloucester Place, W.1.

E. Higgs Travel, Ltd. (629,691).—Private co. Reg. June 5. Cap. £1,000 in £1 shs. Objects: To carry on the business of tourist and travel agency, etc. The directors are: Mrs. Gwendoline I. Higgs (chairman), Araluen, Haslemere Road, Hindhead, Surrey; George C. McEwen, 20 Parkstone Avenue, Emerson Park, Hornchurch, Essex; John M. Dainty, 45 Lancaster Drive, Elm Park, Hornchurch, Essex. All directors of E. Higgs (Air Agency), Ltd. Sec.: G. C. McEwen. Solrs.: Balderson Warren and Co., W.C.2. Reg. office: 9 Farringdon Road, E.C.1.

Ivec Holdings, Ltd. (629,547).—Private co. Reg. June 3. Cap. £1,000 in 1s. shs. Objects: To carry on the business of designers and manufacturers of and dealers in electrical, electronic aeronautical, nuclear and engineering products and accessories of all kinds, etc. The permanent directors are: Mrs. Dean A. J. Sayers, 25 Twatling Road, Barnt Green, Worcs; Mrs. Nina D. Sayers and John W. Sayers, both of Corkey, Ballymena, Co. Antrim. Sec.: J. C. Allday. Solrs.: Glaisyer Porter and Mason, Birmingham. Reg. office: 25 Twatling Road, Barnt Green, Worcs.

New Patents

APPLICATIONS ACCEPTED

817,442.—Curtiss-Wright Corporation. Flight simulating training apparatus. July 5, 1955 (July 22, 1954).

817,442.—Rolls-Royce, Ltd. Aircraft. October 11, 1956 (September 1, 1955).

817,508.—Rolls-Royce, Ltd. Aircraft structures. October 11, 1956 (September 1, 1955).

817,511.—Fairey Aviation Co., Ltd. Aircraft. March 8, 1956 (December 8, 1954).

817,207.—General Motors Corporation. Gas turbine aircraft engine coupled to drive a variable-pitch propeller. May 21, 1958 (May 28, 1957).

Printed specifications of the above will be available on July 29, 1959, and the opposition period will expire on October 29, 1959.

Personal Notices

BIRTHS

Blakeley.—On June 1, at Jasmine Cottage, Welby, Lincs, to Barbara (*née* Hawthorne), wife of Flt. Lt. Barry Blakeley, R.A.F.—a daughter (Elizabeth).

Carroll.—On June 5, at Caergeiliog, Anglesey, to Jean (*née* Baxter), wife of Flt. Lt. B. P. Carroll, R.A.F.—a son.

Franklin.—On May 29 to Teresa (*née* Rice), wife of Flt. Lt. P. G. Franklin, R.A.F.—a son.

Gallwey.—On June 9, at Louth, Lincs, to Lyn (*née* Sharpe), wife of Flg. Off. Ivor Desmond Gallwey—a son (Nicholas Paul).

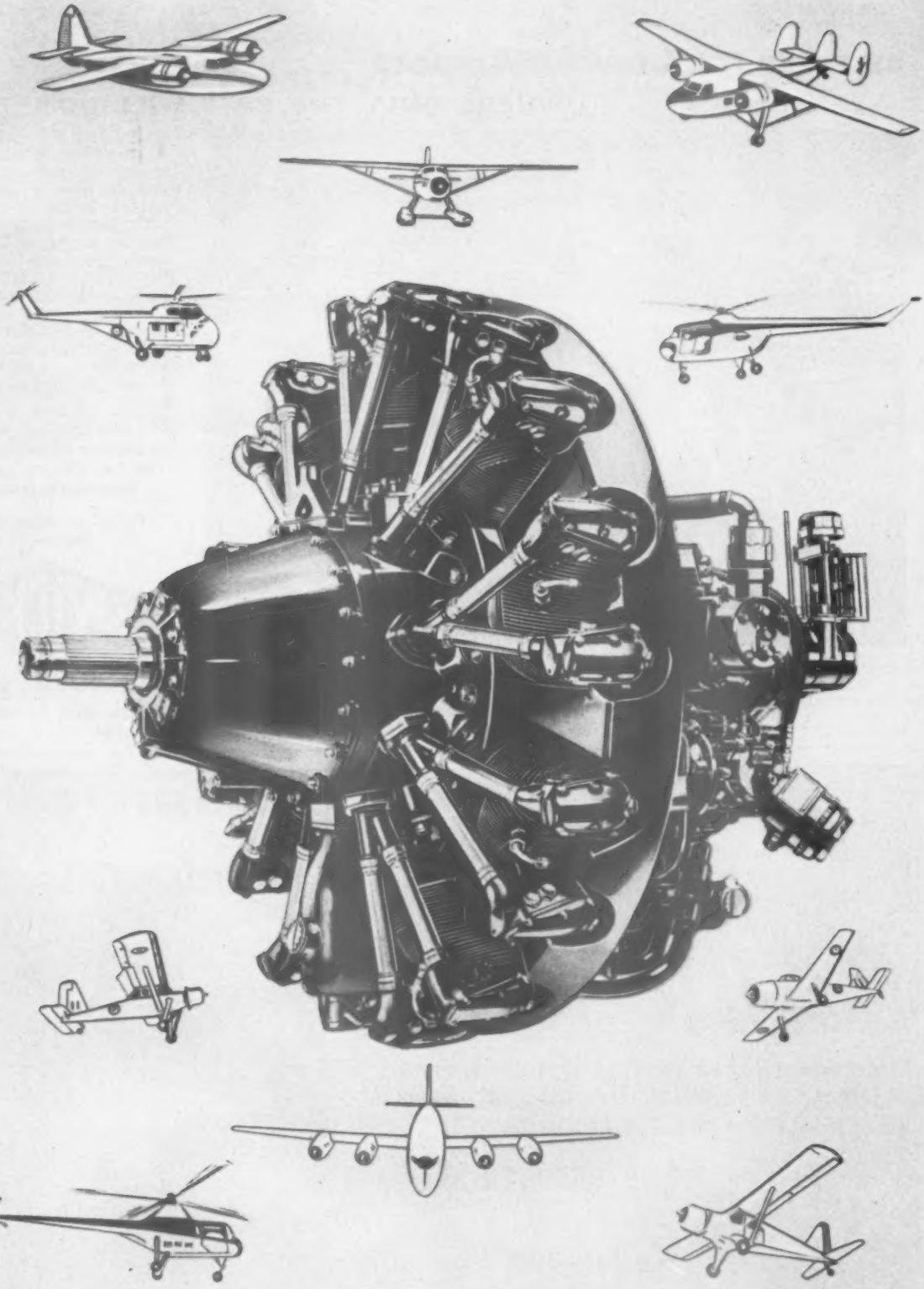
Kelsey.—On May 28 to Judith (*née* Longley), wife of Flt. Lt. W. Kelsey—a daughter.

McKee.—On June 5 to Brenda (*née* Hicks), wife of Flt. Lt. I. K. McKee, R.A.F., Cranwell—a son.

Robinson.—On June 2, at Hillrise Maternity Home, Lyndhurst, to Valerie (*née* Mace), wife of Flt. Lt. W. Robinson, R.A.F.—a daughter (Sarah Nicole).

Stacey.—On June 3, at P.M.R.A.F. Hospital, Halton, to Frances (*née* Faucett), wife of Sqn. Ldr. J. Stacey—a son.

Todman.—On June 7, at R.A.F. Hospital, Wegberg, to Judith (*née* Kelsall), wife of Flt. Lt. D. A. W. Todman, R.A.F.—a son.



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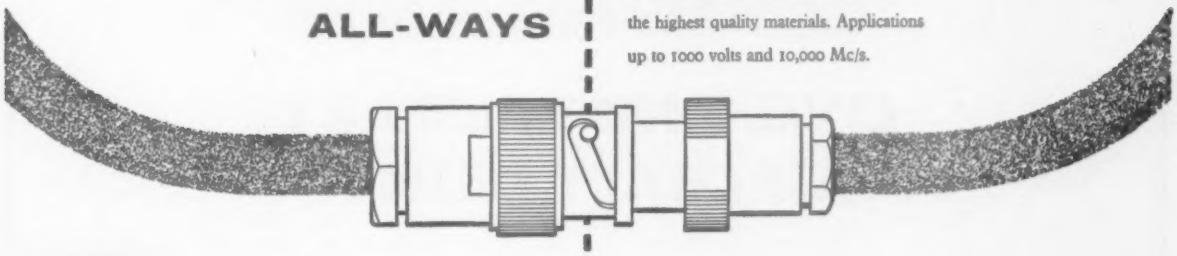

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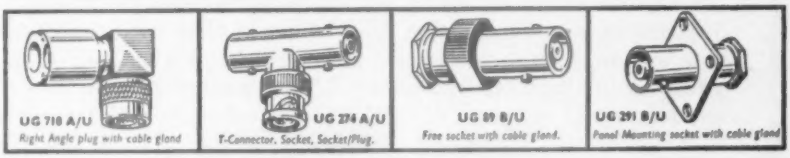
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UG 274 A/U
T-Connector, Socket, Socket/Plug.
UG 89 B/U
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UG 291 B/U
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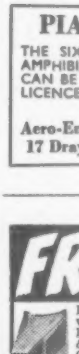

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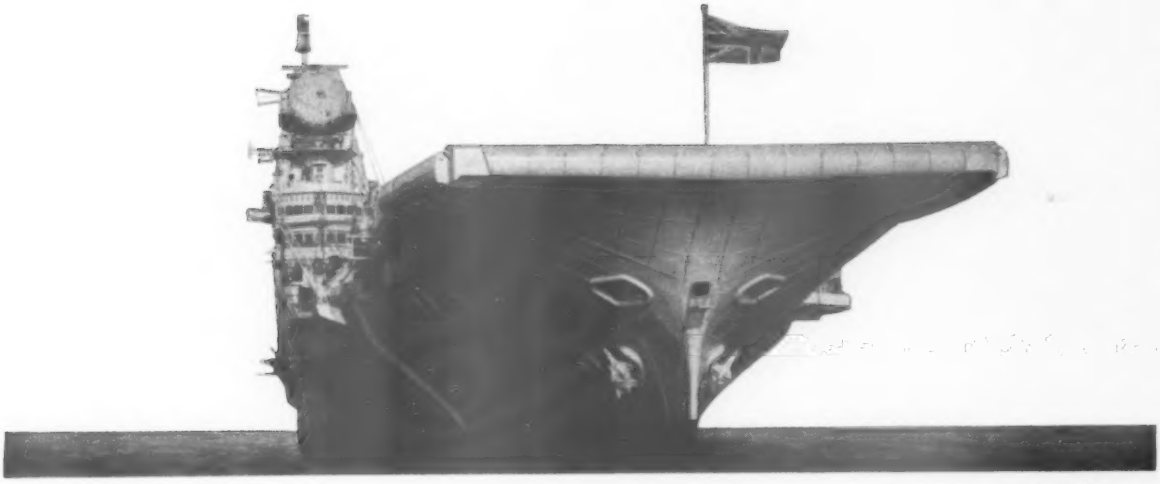

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